



The X-Factor

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Zoom Yearbook no 33

Exhaust systems are where most of the questions have been answered, or have they?

There are plenty of decent exhausts on the market for Holden V8s and many of them work particularly well ' usually providing the power gains that the manufacturers claim. However, that's not to say that there is nothing left for us to learn or try by 'looking outside

the square'. Thus we decided to put together a 'new style' exhaust design in the quest of finding some extra power.

What we wanted to examine more closely was the effect of a properly designed balance pipe system on a Vconfiguration engine. This concept is

simple enough; both of the exhaust pipes of a V-configured engine joined at some point in the secondary length to smoothen the exhaust flow. That's the theory, with the presence of a balance pipe changing the exhaust note, and adding a little extra something to the

power output. This theory was one that all of the exhaust specialists we spoke to **backed up**. The problem is that no-one could be more precise than that, with the actual position and size of the balance pipes being a dark art and something best done on a 'suck it and see' basis

The only documentation we could find was courtesy of the SAE (Society of Automotive Engineers) and even that technical article only devoted one paragraph to the effect of a balance pipe. The only clue given was that the effect of the balance pipe on a V-configured engine has more to do with acoustic dynamics pulse reflection, gas reversion and the like - than it does with flow characteristics. This makes more sense when you realise that a balance pipe changes the way an exhaust sounds.

Very few people understand that basic fact, with exhaust acoustics (how sound waves pulse) being a much more serious issue for power development than actual flow capability. Sure you can't have power without flow, but the diameters and shaping of a given system have a more marked effect on acoustics than anything else does.



The initial problem was how to fit these twin pipes into a 5-inch pipe to make the X system



The 5-inch pipe was first pressed to the right height then ... a rod was used to form the shape

PRODUCTION METHODS

If you have ever looked under a V8 Commodore, you will see that the factory has used a balance pipe. The later model VT Series HSV cars, in some instances, even have two separate balance pipes located about 30cm apart after the catalytic converters. The fact that the balance pipes themselves are located at right angles to the exhaust flow makes you wonder how they could be particularly effective.

Previously, we had messed around with the actual diameters of the balance pipes, changing them from 2.25 inches to 2.5 inches and, yes, we **had consistently gained 2-3kW**. It was the magnitude of the **power gain** that tempted us to look thoroughly at the possibilities of starting with a system from scratch that allowed a

free balance pipe design. The question remained though, - "What do we actually do?"

A chance photograph of a V8 Supercar resting upside down after a high-speed roll over provided the answer. This particular car had the balance pipes set up much differently to the factory arrangement, with power production being the most important factor rather than the simplicity of manufacture and, of course, cost. Rather than being a simple pipe arrangement to join the banks of cylinders, there was an elaborate melding of the pipes to form a long, tubular shape. Closer inspection showed that the two exhaust systems were joined for 8-10 inches - providing my scale calculations were accurate.

OUR PLAN

We planned to build something that emulated what we had seen on the underside of the Supercar, and adapt it for a conventional 'road' car. Commonsense dictated that replicating the system dimension for dimension would be inaccurate, as our engine was going to rev at a maximum of 5500rpm rather than the Supercar's limit of 7500rpm. It was, however, a good basic shape from which to start.

Testing would be a fairly difficult process as well, due to the amount of labour involved in crafting different sets of balance pipes. After a thorough look at what was required, our fabricator, Mark Tilbrook, reckoned he would only be able to make a couple of different sets of pipes



The big, 10-inch X-pipe proved to be the most effective of the two different combinations



The system uses twin GM catalytic converters and twin straight-through mufflers

in the time he had available. Rather than make two sets of X-shaped balance pipes of similar length, there was one set crafted at five inches in total length and another at 10 inches.

The test car was a VS Clubsport and the task was to create an exhaust system that would be good enough for a supercharged application - as was the owner's intention. Mark ordered a set of Pacemaker largediameter headers, which he has used on supercharged installations successfully

FABRICATION

Putting together the X-pipe system itself wasn't straightforward though, with Mark using a piece of 5-inch tube that he moulded in his press so it was suitable for merging the two secondary pipes. About an hour of oxy work, a hammer (for shaping only!) and the MIG welder, turned the pieces of mild-steel tube into the centres for the X-pipes.

The rest of the exhaust was fairly straightforward, with a pair of GM catalytic converters doing the clean stuff at the front of the engine before heading through the X-pipe, the centre mufflers, and out finally through the rear-mounted resonator and the twin tips. The whole system was straight through with no baffles in the crafted stainless steel mufflers.

We weren't really sure that we would achieve anything with the new system in the way of power gain, probably because many of us have been conditioned to believe that miracles are for fairytales. After all, this car was already making 135kW 'out of the box'. With the first short-length, 5-inch X-pipe in place, we got an interesting result - a 7-8kW power gain between 4000rpm and 5000rpm. While this gave the VS more 'urge' at the top end, it didn't endow it with more mid-range urge, which was disappointing. It's worth mentioning that the peak power gain over the standard set-up was fairly reasonable when you consider that no other changes were made to the car.

'The 10-inch X-pipe proved to be the gun weapon, making a huge difference to the mid-range power output while still adding to the top end'

The 10-inch X-pipe proved to be the gun weapon, making a huge difference to the mid-range power output while still adding to the top end. At no stage was the 10-inch X-pipe down on power or torque over the original set-up, with an extra 4-5kW available from 2500rpm. The power curve was still nice and fat approaching the rev limiter, which gave the engine a crisper feel though the gears.

CONCLUSION

While none of the design and manufacture of the X-pipe balance system was particularly scientific, it was effective, with this simple back-to-back test proving that different design changes can affect power output -even in stock applications. The next step would be to design a system that allowed dynamic changes of pipe length while the car was running on the dyno.

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