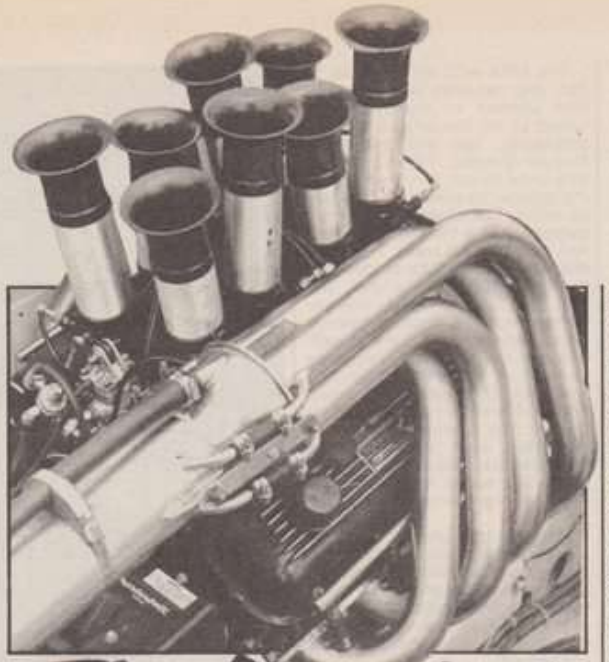


The Sound of SILENCE

Silencing your car's engine is one problem, but silencing a high performance or competition unit is quite another matter since you run the risk of negating all the positive effects of your brand new modifications simply by employing an inefficient exhaust system. What follows should help to put you on the right track to more performance

A David Vizard investigation

Competition Silencers is going to be a name to look for in the future as far as high performance silencers are concerned. Regular readers of **CCC** will remember that I tested a really good experimental silencer about five years ago, but unfortunately it never went into production. Since then I have tested many silencers and have, until now, not come up with one that I can thoroughly recommend. Probably 25% of the silencers tested in the last two years come under the category of junk. That doesn't mean that 25% of the people out there in the world have junk non-original equipment silencers. Unfortunately some of the silencers that came under the heading of junk had a lion's share of the market. This means that a lot of you *think* you have a high performance, straight-through silencer, but in fact you may be using a silencer which gives worse performance than the one the manufacturer fitted as original equipment. By and large, factory silencers are usually in the fair to middling category.

Because there is a very real probability of many readers having junk silencers, we'll start with a simple means of checking your present silencer's, performance potential. As no doubt all readers appreciate, race cars use open exhaust pipes to ensure an absolute minimum of back-pressure and easy exit for the exhaust. Under these conditions, power output is best. This race car criteria applies equally to a road car: minimum back pressure equals more power, and for that matter, better economy. If anyone ever tries to tell you differently, I would either suspect their motives or their automotive engineering knowledge.

The fact that we are looking for zero, or for that matter, even less than zero back pressure, means that checking the exhaust system is not too difficult a job to do. All you need is a short piece of copper pipe which will have to be brazed into your exhaust pipe, some plastic windscreen washer hose, a piece of wood marked off as a yardstick and a few staples to hold the windscreen washer hose into place. Fig. 1 shows the layout you should work to.

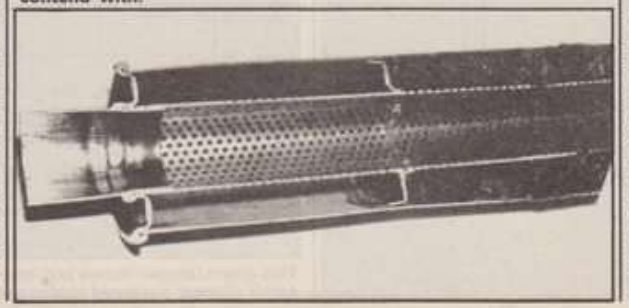
Basically what we have put together here is a manometer. In most instances the manometers used for testing exhausts have mercury in the U-tube. However, mercury is very expensive. For our purpose, water will do. For any given pressure measurement it takes a greater column height of water than mercury. If your silencer is not too good, our manometer is going to have the water blown completely out of the U-tube by the back-pressure, so you won't be able to take a reading, but at least you know you have a bad system.

To avoid spraying water all over the inside of the car, put the end of the U-tube out of the window, so that if it does blow the water out, it won't spoil the upholstery. If you have a good exhaust system, then you will be able to take measurements of the back pressure.

Once the set-up described in Fig. 1 is installed in the vehicle, you will need the aid of an accomplice. The technique for measuring the back pressure is to use one gear only on an open piece of road. The road does not necessarily need to be flat, but it does need to be straight so as not to cause any driving problems. For most vehicles the test will probably be best conducted in third gear. Pull the speed of the vehicle down to the lowest rpm at which you wish to measure the back pressure, then floor the throttle and have your accomplice read the back-pressure in inches of water at each rpm interval required.

Having done your tests, the question of what is acceptable and what is not arises. That in itself is a difficult question to answer. If we are looking for maximum performance, then only the minimum amount of back-pressure is acceptable, and whatever system produces the lowest backpressure is the one you need to go for, but such decisions have to be tempered in respect of how much a new exhaust system is going to cost and how much life is left in the one you already have. If you have a really good exhaust system, it should show less than 2" of mercury (27" of water) back-pressure at maximum horsepower rpm. However, a system with this little amount of back-pressure is going to be a rarity. Those of you who do go to the trouble of checking your exhaust back-pressure will probably find that it is, in the majority of cases, between about 7" and 12" of mercury. Straightaway this means the loss of a substantial amount of power. Depending on the engine, you can figure on between about 5% and 8% as being typical. The more extensively modified your engine is or the more sophisticated it is, i.e: a four valve per cylinder Ford engine, then the more the horsepower is going to be affected by exhaust back pressure.

To see what was inside, (below) I cut a main silencer of the MAX-ACC 40 Series pair in two. It looks simple enough but pre-chamber volume, hole size, total volume and glassfibre packing density are all said to be important. All this, plus the contents and positioning of the pre-silencer, amount to a large number of variables for the designer to contend with.



This silencer (below) appears to be stoutly made. A very generous rolled/crimped edge allows, for expansion and contraction of the box without introducing unnecessary stresses which can bring about cracking. The pipe itself is both crimped and seam-welded into the case and so should withstand the shock loadings imposed by even the most severe rally conditions.

In general terms then, we are trying to get rid of back pressure, and the subject of our story is a silencer designed by Competition Silencers which is specifically for BL Series 'A' engines. The silencer in question is the MAX-ACC 40 Series silencer. Now this company will be producing silencers for other high performance applications, but for further information you will have to watch the ad sections in various performance motoring publications. As of now, the subject of our test is the silencer for Series 'A' engines. The reason this one particular unit has been singled

out for a specific silencer design is that siamese port engines represent a slightly different kettle of fish when it comes to silencer design than do more conventional engines, having one exhaust port per cylinder. If you have been to a race meeting you will know for a fact that Minis produce one of the most invigorating engine notes there is. A typical race Mini engine seems to be able to generate enough noise to drown almost any other single race car at the meeting.

Whatever the reason for this high noise level, one thing is for sure, it does present a problem when it comes to designing a high performance silencer. Whether we are considering a straight-through or a baffled silencer, it is found that many silencer designs manage to reduce the noise level of the Mini engine not by effective silencer design, but by constricting the flow through them. This constriction causes high back-pressure and the net result is that *power and economy* suffer. Competition Silencers' MAX-ACC 40 Series silencer is a true straight-through unit. Daylight will pass from one end to the other with no interference. Check this out with many of the other silencers on the market and you will realise that some of the so-called straight-through silencers are not quite as straight-through as they could be. Sometimes the two exits provided by some silencers are not there to allow the gases an easier route to escape, but are installed to give the impression of free-flow and to prevent prying eyes from seeing any possible constrictions that exist inside. However, designing a straight-through silencer that actually silences without giving any back pressure is a very difficult task.

The MAX-ACC 40 Series is, in fact, two separate silencers. The first silencer in the system is tuned to be responsive to high amplitude, low and mid-range frequency noise. These it damps to a large extent, but in so doing, it produces its own high frequency noise. The second part of the system, that is the main silencer, has a number of tasks. The main silencer itself can be considered to be two units in one case. The first part of the main silencer damps out the high frequency noise generated by the first sub-silencer and any high frequency noise that has passed through that first sub-silencer. The main body of the silencer which is packed to a specific density with glassfibre, then damps out the mid- and low frequency noises to produce a sound level below the required legal noise limit at the tail pipe.

Although the silencer looks relatively simple, the maufacturers claim that it only achieves its high level of performance and noise reduction by virtue of a great degree of fine tuning and optimising of all the various aspects concerned.

One of the engineers concerned with the design of this unit was quick to point out that it had not been designed *down* to a price, but *up* to a specification. As far as quality is concerned, this statement appears to hold true. Unlike many silencers, the unit appears to be well constructed. As far as performance and economy are concerned, the only way to establish the difference between fact and fiction, advertising claims and reality, is to go to the dyno.

Our sample test unit from Competition Silencers found its way onto two test engines. One was a bog standard 1275 GT engine

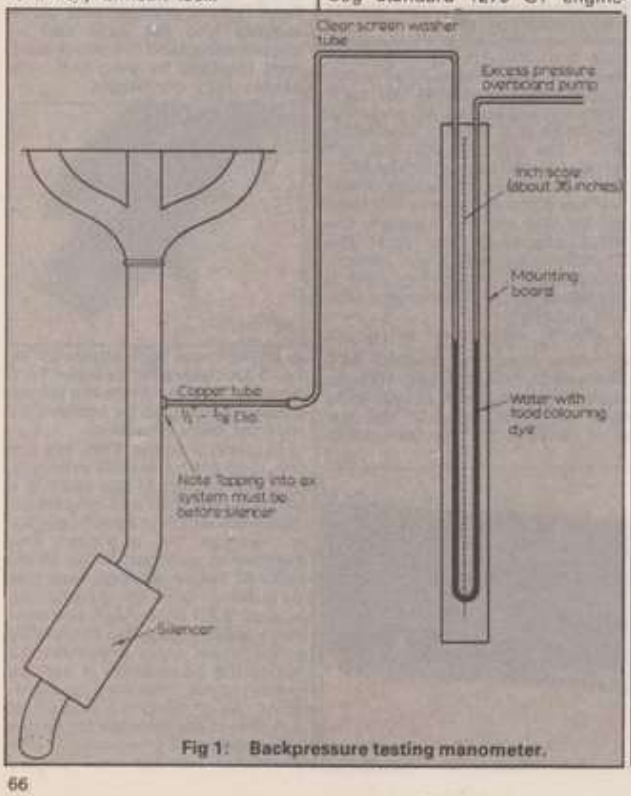


Fig 1: Backpressure testing manometer.

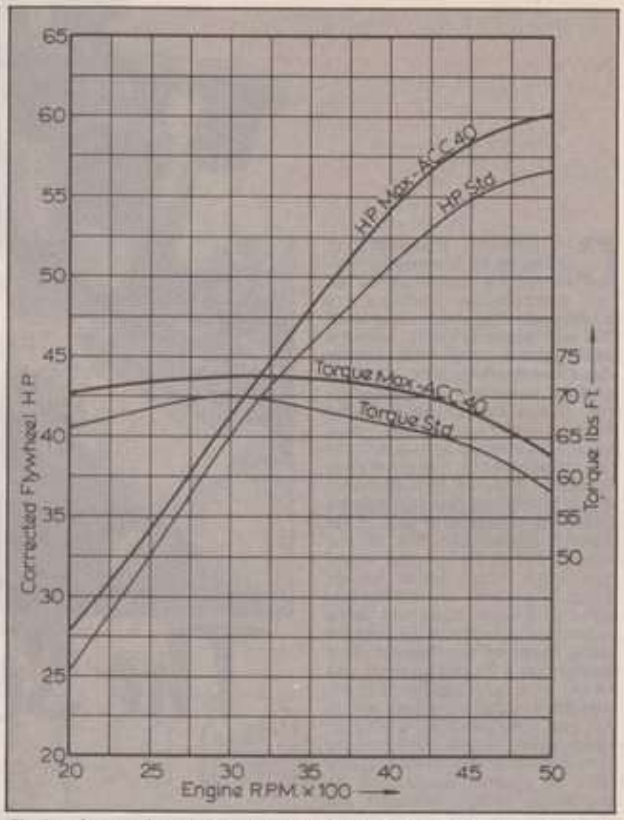
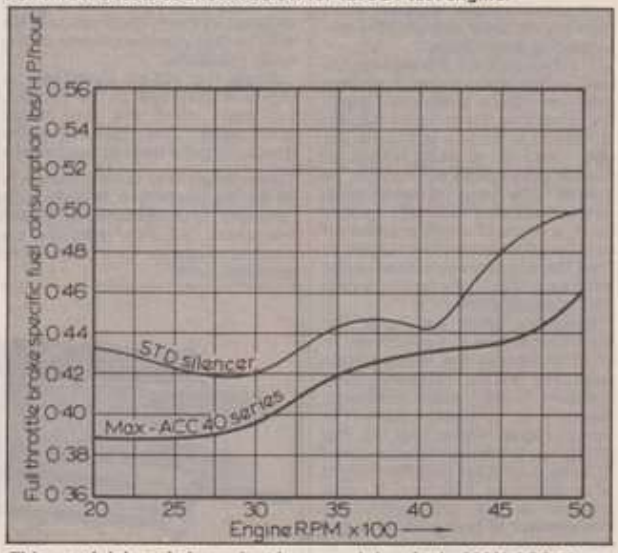


Fig 2: Comparison (above) between standard 1275 GT silencer and Competition Silencers MAX-ACC 40 series for BL 'A' series engines.

	Torque		HP	
R.P.M.	Std-	Mdf-	Std-	Mdf-
2000	66.1	70.2	25.2	27.8
2500	68.5	71.8	32.6	34.2
3000	70.0	72.2	40.0	41.3
3500	68.4	72.2	45.6	48.1
4000	66.2	71.1	50.4	54.1
4500	64.0	68.1	54.8	58.4
5000	58.5	63.2	55.7	60.2

Fig 3: Fuel consumption tests for standard and MAX-ACC 40 series silencer. Part throttle road load curve showed a minimum mpg increase of 4.2% and a max increase of 8.1% at steady speeds over the 30–70mph range when MAX-ACC 40 was installed.
Full throttle tests as shown below for 1275GT test engine.



This graph (above) shows just how much *less* fuel a MAX-ACC 40 series silencer-equipped engine used to make *more* horsepower.

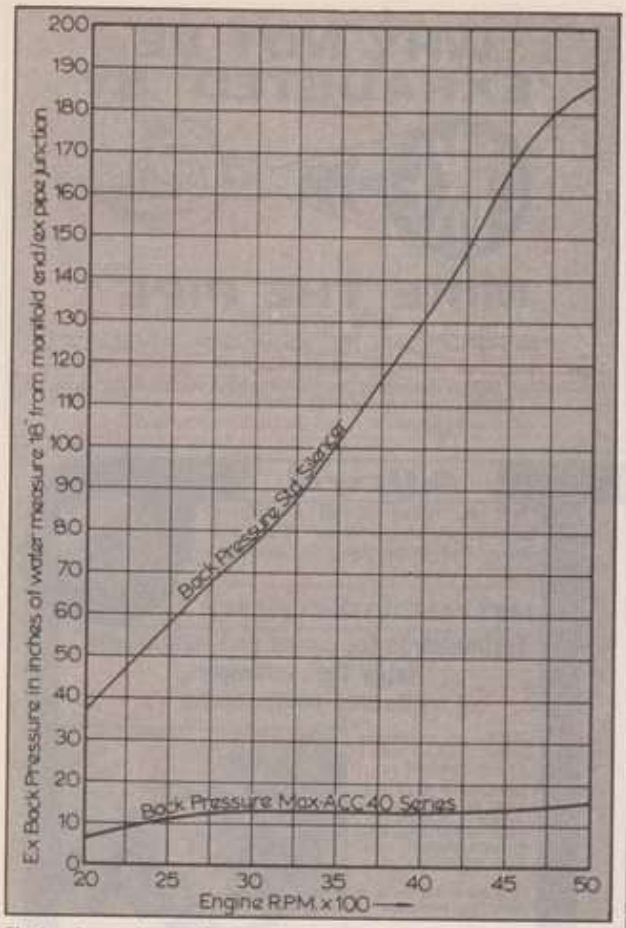


Fig 4: Comparison of exhaust backpressure for standard 1275GT silencer and MAX-ACC 40 series silencer at wide open throttle. The dramatic difference in exhaust backpressure is graphically shown here. If you are going to test your own exhaust system by using the manometer in Fig 1, remember the limit you can test to is equal to the floor to roof height of your car. On this particular test, the manometer in Fig 1 would have reached its limit at 2000rpm with the standard silencer.

with blue-printing only to encourage its power output, and the second engine was a 1275 'S' unit in modified form. As can be seen from the power curve, this particular engine gave just shy of 100bhp.

The first tests on the standard 1275 engine were the most difficult to carry out because they were intended to show not only the power and torque increase, but also the difference in fuel consumption that should be possible if this unit did as it was claimed. Getting accurate and repeatable measurements of fuel consumption can very often be an extremely time consuming occupation. For this reason, you are only being presented with fuel consumption figures on the one engine. Also on this same unit, back pressure of the exhaust system was also measured. On the second engine the only tests that were carried out were in relation to the performance of the silencer and an open exhaust pipe.

Starting with the standard 1275 engine first, we see from Fig. 2 that comparisons are being made between the standard BL silencer as fitted to 1275GTs and 1300 type cars and the MAX-ACC 40 Series. The BL silencer is a typical middle-of-the-road silencer. There are others on the market a lot worse and there are a few a little better, so by and large it was considered to be representative of a good all-rounder. The intention here is that if the subject of our tests shows any improvements, then it does indicate that it is a better than average silencer, and with that in mind, let's look at the results shown in Fig. 2. As you can see from these figures, both HP and torque took a jump, but that's only part of the story. The other part is how much fuel an engine uses to develop its power. A look at the graph, Fig. 3, will show how much less fuel the engine used at any particular rpm to produce each horsepower that it developed.

Lastly, back-pressure – how did that fare? Tests conducted while we were taking our power readings with a mercury manometer showed a dramatic reduction in back pressure. For the purposes of our chart, the mercury figures have been converted to water so that those readers who checked their own back-pressure can relate the back pressure numbers that they achieved with the back-pressure figures in the chart, Fig. 4. Back pressure figures given by the Competition Silencers unit proved to be just about where you would expect a straight open exhaust pipe to be. However, a 60 horsepower engine is not by any means a super high performance engine, and although this silencer has proved its worth for a mundane type of application, the question that many of us would need answering now, is how it would work out on a highly tuned unit which would be more representative of a rally or high performance road car.

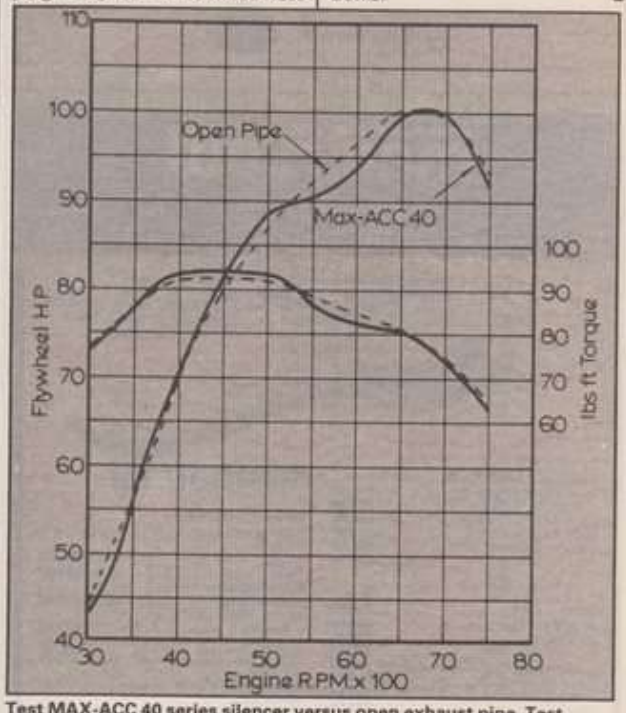
This brings us on to our number two test unit. This sported a pair of 1½"s, a modified head, a 544 cam and an LCB exhaust manifold. The C.R. was 10.5/1. The graph, Fig. 2, show the power and torque difference between the Competition Silencers' MAX-ACC 40 Series and a straight open exhaust pipe. These figures are just as they came off the dyno with their correction factor. As you can see, the two sets of figures are very close, and within this sort of power band range, it is difficult to believe the dyno figures to closer than two horsepower. In some places our test engine showed more power in its silenced form than the open exhaust, and in other places the situation was reversed.

As far as noise level goes, Competition Silencers' MAX-ACC 40 Series scored well. When judged by ear it sounded less noisy than the standard silencer used for the first test. However, the meter showed that it was about 3% louder over most of the rpm range.

For readers with Minis, the system comes with a pipe to connect it to the manifold. When the system is installed it is imperative that the pre-silencer be installed with a 12" to 18" piece of pipe between it and the main silencer. This applies in all cases, whether it's a Mini or not. If the correct distance between the pre- and main silencer is not adhered to, it is claimed that the noise level can be affected, and somebody's carefully calculated noise formulae no longer apply.

At the time of writing, this silencer is available on a mail order basis only. When you order, you will need to state what vehicle it's for; i.e: 1275GT, Austin Healey Sprite, MG 1300, etc. Your order, of course, needs to be accompanied by some sort of remuneration. The cost of this silencer assembly is £29.50 plus VAT which brings it up to £33.22. On top of this you must also add £3.50 for post and packing.

Once you have your silencer assembly you should find that any good exhaust system shop should install it for you for the minimal dispensation of a few more sheets of green paper. Send your order to: Competition Silencers, Mercantile House, 99/101 St. Leonards Road, Windsor, Berks. ■



Test MAX-ACC 40 series silencer versus open exhaust pipe. Test engine: modified 1275 'S'.

	Open Pipe		Max acl 40	
RPM	HP	Torque	HP	Torque
3000	44.0	77.0	43.4	76.0
4000	70.1	92.0	71.0	93.1
5000	87.1	91.5	98.5	93.0
5500	92.2	88.1	90.1	86.0
6000	96.5	85.5	93.6	82.0
6500	100.4	81.1	100.2	81.0
7000	99.9	75.0	99.9	75.0
7500	92.6	64.9	92.5	63.9