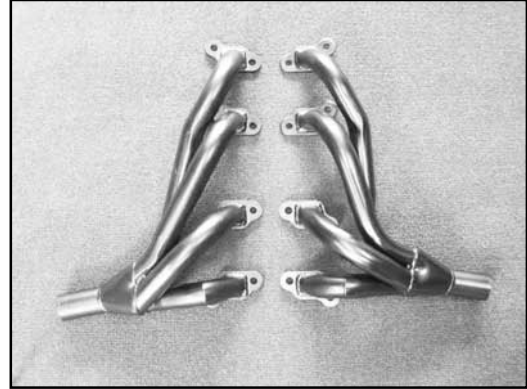


Choice of Rover SD1 Exhaust Manifold



The Question: Posted by Rover SD1 Club member, Dave Plowman's question reflects most owners' thoughts when they consider fitting a stainless steel exhaust system to the Rover SD1 V8 Engine.

"It's said the standard EFI cast manifolds are a pretty good design. Would be interested to know if the tubular ones are any better on a standard engine?"

Interesting question begs an answer that most people think is obvious - "Of course they are better!" But hold on for a moment. First define 'Better'! Better for What, Better for Whom? Better How?

Exhaust system sellers tell of advantages related to "gains" (for which, read "fewer losses") in performance but what of the unspoken disadvantages? In today's motoring environment of traffic congestion, noise, high fuel costs, the demise of 'Boy Racers' and the quest for originality; environmental and/or personal disadvantages might outweigh any "gains" in performance.

Then there is the business of perception versus reality! Not-with-standing subjective anecdotal experience on the one hand and potential rolling road results on the other, when researching exhaust information for an essay on the subject of Rover SD1 V8 Exhaust Systems, many upshots were discovered by simply analyzing basic practical, engineering and scientific issues as they relate to the single subject of Rover SD1 V8 Engine Exhaust Manifolds.

The Exhaust Manifold Issues: After the air/fuel mixture burns, apart from being "hot as hell", the leftovers consist of variable amounts of water vapor, a few unburned hydrocarbons (fuel), carbon monoxide, carbon dioxide, nitrogen oxides, sulphur dioxide, phosphorus, and the occasional molecule of a heavy metal, such as lead or molybdenum.

Mostly, this is all in gaseous form under a lot of pressure as the piston rushes them out of the cylinder and into the exhaust manifold which must now deal with that hot corrosive mixture, virtually forever, without deteriorating. Tough Job!

The three-fold choice of material in the period came down to:

- cast iron.
- mild steel.
- stainless steel.

The original Rover SD1 V8 manifolds were made from cast iron for two reasons:

- Importantly, heat retention - see later **.
- Low cost.

Mild steel, technically easy to work with, would be impractical in billet form and an unlikely material for tubular headers, being too vulnerable to corrosion at that very hot exhaust location.

Stainless steel is harder to fabricate and very expensive, material-wise, unless thin enough to minimize the cost.

The primary purpose of the manifold is to funnel several exhaust ports into one collection point, thereby avoiding multiple pipes sticking out the back of the car. Hold that thought! Tee-Hee!

Exhaust manifolds are usually quite restrictive to the flow of exhaust gas and thereby waste power because the pistons have to push on the exhaust gasses pretty hard to get them out.

The performance alternative to the cast iron manifold is a header with precisely formed tubes that curve gently to join the exhaust ports to the exhaust pipe.

Not so cheap but also lots of surface area to radiate heat into the engine bay compared to the cast manifold which retains heat better but has several holes converging variously to route gasses away.

** The issue of heat retention is also important to relative performance. Generally the hotter the better because cool gasses are heavier and require more immediate energy to expel them.

The design of a solid manifold can only ever be a compromise whereas the design of a header may achieve significant improvements, yet still be limited by space and suitable materials.

Other Considerations: Tubular headers can be made smooth all the way through because (as with a fluid) the gasses must flow as freely as possible for maximum efficiency.

Headers can be tuned by choices of diameter and length to alter an engine's characteristics.

With exhaust gases leaving the engine under extreme high pressure, it's hard not to be aware of the noise barrage generated if they are allowed to escape to atmosphere directly from the exhaust ports.

For the same explosive reason gunshots are loud, so engine exhausts are loud. It may be cool to drive around on the street with a chest-thumping 150 decibel roar, but society is intolerant to these intrusions. Apart from the subsequent silencing process, the crackling noise is better suppressed/absorbed by cast iron than thin steel.

Heat retention on headers can be improved by wrapping the pipes with special insulating material or ceramic coating.

Summary: (Involving repetition, hopefully, from helpful/differing viewpoints) Tubular headers incur less loss of performance than cast manifolds due to their improved gas flow characteristics.

Contrary to the above, more energy is used to expel cooler, higher density gasses from thin material headers that lose heat more readily.

The considerable design effort put into the cast iron exhaust manifolds had to optimize diverse factors such and economy, comfort and performance.

Headers allow the designer to select pipe diameter, length and shape, and thereby tune for optimum performance, but possibly to the detriment to economy and comfort.

On balance the performance gains appear to outweigh the losses.

Heat lost via tubular headers is retained in the engine bay causing destructive stresses not originally considered when selecting engine cables, loom protection, electrical connectors, fuel pipes and component location generally. It also encourages vapor lock on Efi engines.

Heat loss from tubular headers can be mitigated by exhaust wrap or ceramic coating.

Neither cast iron manifolds nor tubular headers, even of perfect design, can add power to the output of the engine. They can only limit the loss of energy by their efficiency.

Apparently the best Manifolds/Headers are "none at all", ie: wide open to the atmosphere.

Environmental and driving comfort aspects are worse with tubular headers due to increased external and internal noise.

Conclusions:

- Tubular or Cast Iron?
- Better or Not Better?
- Performance or Comfort?
- Balls Out or Compromise?

It all depends on the objectives but for out and out performance advantages, the tubular manifold has significant potential, but downsides occur on economy, comfort and heat.

More Exhaust Stuff: Anyone wanting to review additional Rover SD1 V8 Engine Exhaust System discussions regarding all the other aspects of design (pipe size, silencer types/choice, heat, cost, back pressure, tuning, etc) can download a full essay in PDF format from here: (43kb)

http://www.vintagemodelairplane.com/pages/Downloads/Rover_Tasters/Exhaust01.html

An excellent read!

Ramon Alban

www.vintagemodelairplane.com