

# Supercharge! Chapter 1

## SUPERCHARGING YOUR VOLVO CHAPTER ONE: "WHY?"

by Greg Sievert

As many of you probably know, I am about 5 months into my supercharged Volvo project. It is by no means complete, but I am getting close. I thought it would be fun to write a series of magazine articles about my experiences, so here is Chapter One.

First, you might ask "Why would

turbo, and many of the newer FWD Volvos) you would probably find the older 240's to be somewhat lacking in the oomph department. Hence, I made the decision to seek additional power for our 240. The project would also be a great excuse for me to do some inventive tinkering as opposed to merely replacing worn or broken parts.

There are many ways to increase the power of a car's engine. Some are really expensive and require specialty capabilities for machining the guts of the engine, with relatively little power

people have done this type of engine swap. Well, I decided I'd like to try something a little different, especially since one Volvo wrecker on the west side of town quoted me about \$3500 all up for the parts to swap over a late-model 740 Turbo engine to the 240. That's a lot of money! Plus, it's more or less a bolt-on and exchange of parts, so it wouldn't be that much of a challenge.

I was perusing the parts peddler magazines and saw something that I couldn't believe - superchargers for under \$400 each! Wow, I could get one and bolt it onto the Volvo. Simply fabricate some brackets and pipes, hook up the belt, and have some awesome power! So I started reading up on these budget superchargers. It turns out that the local Japanese car wreckers import large quantities of wrecked high-performance Japanese cars from the homeland. Many of these models are not even available for purchase in Australia. The superchargers being offered are from Toyota models. Two sizes are available: large (from the Toyota Supra with a 2 litre in-line six engine) and small (from the Toyota MR2 with a 1.6 litre 4-cylinder). Well, the Volvo engine is 2.3 litres, so it was recommended that the larger supercharger would be more suitable. The larger supercharger is used by a local hotrod shop (Castlemaine Rod Shop). They offer a full kit for Commodore 3.8 litre V6 engines, so it should more than suit the smaller Volvo engine.

So, just before Christmas, I bit the bullet and bought myself one of these superchargers. I found out later that the Toyota name for it is SC-14, because it delivers 1.4 litres of air to the engine for every revolution of the supercharger. This calls for a little more theory on superchargers and turbochargers. Both devices are designed to force more air into the engine, which, along with more fuel, comes more power. Turbochargers are driven by the exhaust gases exiting the engine. The great thing about a turbo is that it doesn't really "use" any power - it basically converts the waste heat energy of the exhaust into mechanical energy that it uses to spin a compressor that pumps air into the engine. From an efficiency standpoint, this is a good

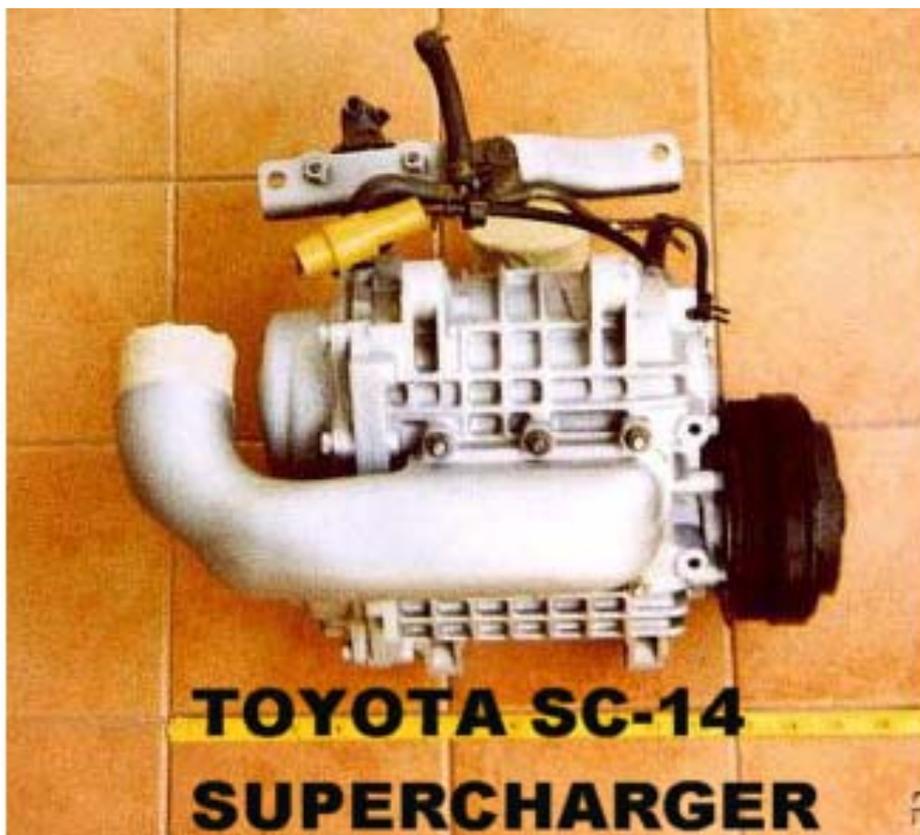


Figure 1: Toyota SC14 supercharger

anyone want to add a supercharger to a Volvo?" This is the question that many people at work have asked me, and the answer is simple: I'm a certifiable Volvo nut and I like my cars to have ample power. The car in question is our 1988 240 GL 5-speed. In its current naturally aspirated state, it has 85 kilowatts (114 horsepower for those of us who have no idea what a kilowatt is!) You could argue whether or not 114 hp is adequate for a car of the 240's mass. I would say for the average driver, it is just adequate with the 5-speed manual. However, if you're used to driving more powerful cars (for example, Commodore V6, any Volvo

to be had in the long run without other major modifications to the injection, intake, computer & exhaust. Others, like adding nitrous oxide injection, are pretty radical and probably would have a detrimental effect on the engine's durability over time. Supercharging and turbocharging would appear to be more of a bolt-on modification. With the B230F engine, you could pretty easily bolt on a standard Volvo turbo set-up from a 740 Turbo. Modifications to the fuel system (use the 740 Turbo injectors, computer, etc.) and maybe even compression would be required if you were to use boost pressures over 5 psi. Quite a few

thing, because some energy that normally flows out the tailpipe is recycled back into the system. Superchargers, on the other hand, are mechanically linked to the engine, usually via a belt drive off the crankshaft. The drawback of a supercharger is that it uses energy from the engine all the time, reducing engine power available to be transferred to the road. So, supercharging generally isn't as efficient as turbocharging.

There are other differences between turbocharging and supercharging that are worth noting. Turbos are notorious for having lag. Lag is the phenomenon that is observed when you step on the accelerator pedal, then you wait, then WHOOSH on comes the boost and the car rockets away. The reason for lag is that the engine, at lower revs, is creating less exhaust flow. Less exhaust flow means less energy that the turbo can use to spin the compressor, and less boost, so less power. When the revs come up, the turbo can spool up, the boost increases,

and you have more power. On newer cars, the turbos have been generally reduced in size to allow them to spool up quicker. This reduces lag, but limits the maximum boost pressure that the turbo can create (hence the name "light-pressure" turbo). Superchargers are quite different. There are two main types of supercharger: positive-displacement and centrifugal. Positive-displacement superchargers, like the Toyota SC-14, deliver a fixed volume of air for every revolution of the supercharger pulley. This means that they are able to provide boost almost from idle speed in a very progressive fashion. Typically, there's no instantaneous burst of power like you might experience with a turbocharged car. It's more of a linear response with a supercharger. Centrifugal superchargers are more of a combination between a turbo and a supercharger. They use a belt drive, but they have a centrifugal compressor. The centrifugal compressor has to spin quite fast to create boost, so centrifugal

superchargers often don't have the low-down boost that positive-displacement superchargers create. This means they can exhibit some of the tendencies of turbos in that they can have some lag and offer less smooth power delivery than the positive-displacement supercharger.

Well, that's enough theory for now. In the next chapter, I'll begin to look at how to actually fit the supercharger into the Volvo's engine bay, and the hurdles involved there. Let's just say it was a bigger challenge than I had anticipated. If anyone's interested in seeing the work in progress, drop me an e-mail at [gsievert@tpg.com.au](mailto:gsievert@tpg.com.au) or call 9397-5976 after hours.

Regards,

*Greg*



Figure 2: Next Chapter: "Will it Fit?"