



Tech Article Title	Author	Date
Bypass Valve Testing	Don Pavlik	2001

A while back I had a pair of stock bypass valves fail -- both with [torn diaphragms](#). I put new stock valves back in but with the recent introduction of the **Forge Stealth** valves I decided it was time to get a good set of valves. I didn't want to have to worry about the OEM Bosch valves failing again. I purchased my Forge Stealth valves from [Stramosphere](#).

I chose the Forge valves over other possible choices for several reasons:

- Forges are serviceable. Both the piston and the o-rings are easily replaced should the need arise.
- I preferred the black finish over other finishes available.
- Forges were readily available
- They fit into the stock location and look totally stock. Some valves I looked at would not fit in the stock location easily.

The Stealth Forge Valve

click to enlarge images



- Stock valve vs the Forge
- The stock valve uses a rubber diaphragm while the forge uses a solid piston.



- Hard to see, but two o-rings are used as a seal between the valve body and the piston.
- The piston seats against the angle at the bottom of the valve



- The piston
- I don't know what it's made of (some type of plastic or nylon) but it's clearly not going to tear like the flimsy rubber diaphragm of the stock Bosch valve.



- The valves in place. They are just a smidge bigger than the stock valves but fitment is not a problem.
- To the untrained eye they look just like the stock valves.
- The stock vacuum hose for the LH valve was too small. I had to replace it with a larger hose.

Testing

The Forge is available with two spring rates -- a green street spring and a blue race spring. I'm using the street springs. A friend has the blue race springs. So how does the valve compare to the stock valves? The Forge is a hefty well crafted piece that dumps pressure quickly when opened then firmly snaps closed when vacuum is released from the nipple. The stock valve? Well... uhhh, it's uhhh, crap. Sometimes it sealed on release... sometimes it didn't. Simply pathetic for valves with only a few

thousand miles running stock boost pressure.



The Test Jig

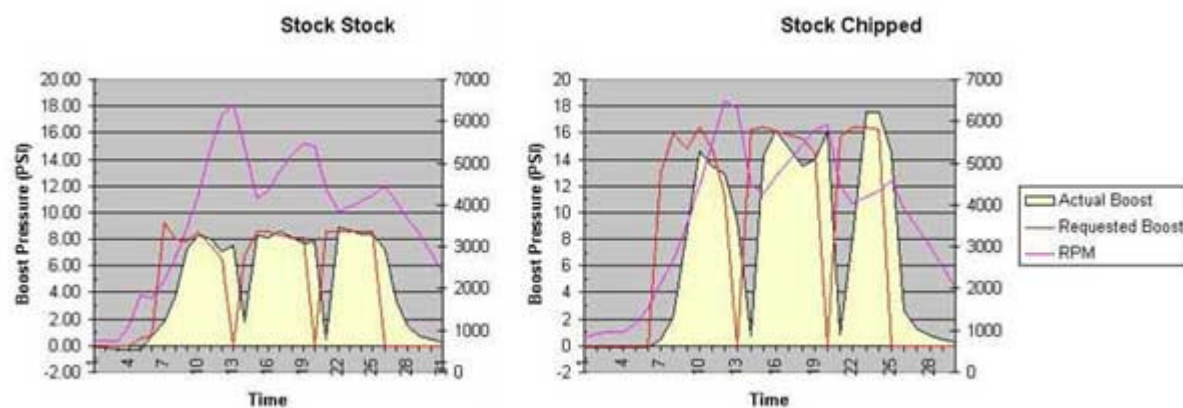
To compare valves I did a few simple tests. First, I checked to see how much vacuum was required to pull the valve open with 1 PSI of pressure on the on the outlet side of the valve. I used slight pressure on the outlet so I could hear air leak through the valve when it started to open. And, I checked how much pressure was needed to push the valve off it's seat to compare spring pressures. The way the valve functions on the S4 boost pressure is applied to the *back* of the piston (via the nipple) so boost pressure actually holds the valve closed when you're on the throttle. The spring rate does not indicate how much boost pressure the valve will hold but rather how hard it is to pull it off the seat with vacuum. So, when I say it took X amount of pressure to push the valve open that doesn't mean that boost pressure is going to push the valve open. Engine vacuum pulls the valve open. I planned to have another brand valve in this test but discovered they were not in proper working order so I've excluded the results.

Forge vs Stock Bosch Bypass Valve

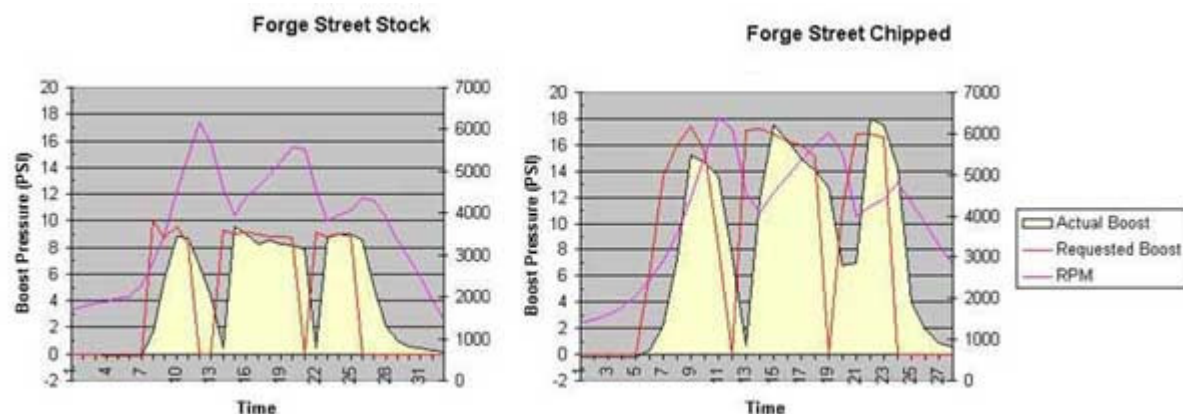
	Stock	Forge Street	Forge Race
Pull open (inhg)	less than 1"	2"	6"
Push open (PSI)	3	5	9.5

In the graphs below the red "Requested Boost" line is the boost pressure the engine computer was calling for. The red line abruptly dropping is the result of lifting off the throttle to shift gears. The steeper the positive slope of the red line the sooner I was back on the throttle. I did not stay into 3rd gear very long... I was more interested in seeing how boost recovered (and not getting a ticket). This data was captured with VWTool using data block 115. These graphs represent boost pressure on full throttle 1-2-3 runs.

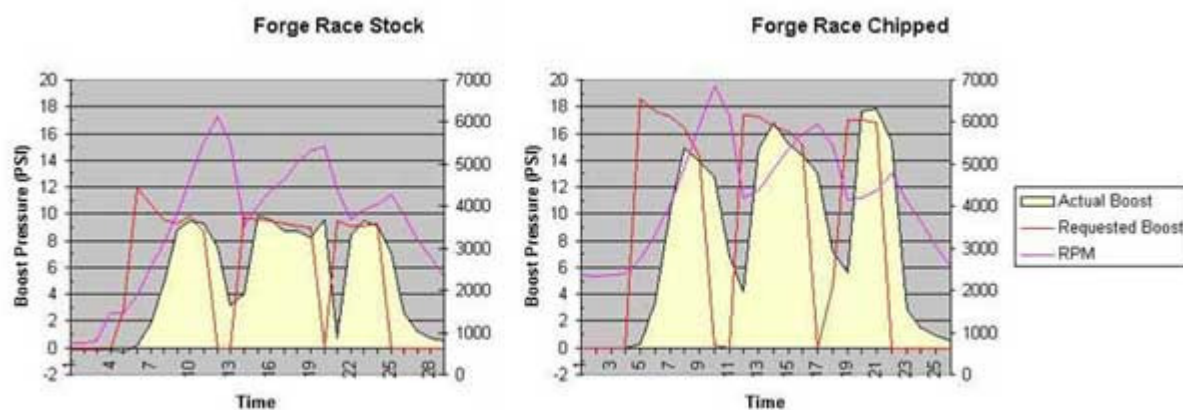
Note that boost pressure held between gears is influenced by the time I took to shift. I will be doing additional testing without shifting (just chopping and reapplying the throttle) so that boost hold and recovery times are more consistent. Note that "Stock Stock" means: Stock valve, Stock boost. "Stock Chipped" means: Stock valve, chipped boost... and so on. All runs were performed on the same car with the various valve configurations.



Note the boost spike on the 2-3 shift on the "Stock Chipped" valve after I lifted off the throttle. Boost wasn't dumped quick enough resulting in a boost spike to 16 PSI. I'm not sure why there's a spike... perhaps the valve can't dump enough air volume to be effective when running 1.0 bar of boost. The dip in boost pressure on the chipped run is also odd although... given it's substandard performance on static tests I guess I shouldn't be all that surprised. There is a small boost spike on the 1-2 shift with stock boost levels too. I didn't expect to see boost spikes given the light stock spring and the fact the valve pulled open with less than 1" of vacuum. Puzzling.



On the chipped run with Forge street springs I did a clean shift and was rewarded with 7 PSI of residual boost pressure without any boost spikes to stall the turbo. Reduced turbo lag between shifts -- yahoo.



The race springs, for this simple street run, don't appear to offer much advantage over the street springs. On a race track where a tenth of a second is the difference between winning or losing they might be worthwhile.

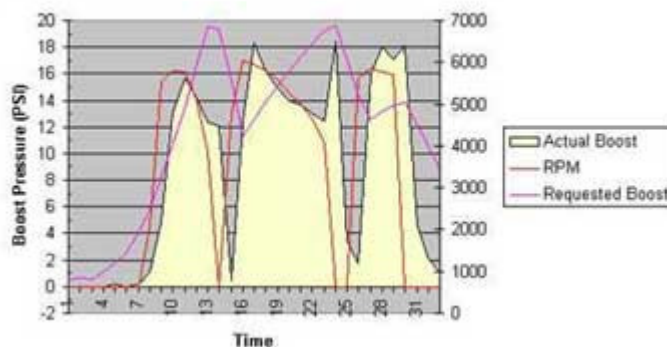
Seat of the Pants

In the few miles of seat time I've had with the valves I honestly have not noticed much difference in throttle response. I suspect part of the problem is I've just been playing around on deserted roads so there's not much to judge myself against. From the captured data boost is clearly present between shifts. The true test will be driving around in traffic where boost lag will be most obvious. Stand-by.

Update

After some seat time with the Forge valves I've come to the conclusion that if you shift correctly you'll be rewarded with reduced turbo lag between shifts. I'm **not** talking about "abuse the car shifts" by slamming or forcing it into gear or anything dramatic... just quick, well executed shifts. In spirited slice and dice traffic mode the car lunges forward with an urgency not present with the OEM valves.
<nodding><smirk> Yep, this is a good mod.

Yikes! Boost spikes!



This data is from a pair of valves (not Forge) that were not in good working order. The boost spikes are the result of the valve not opening properly when lifting off the throttle. Note the boost spike to over 18 PSI after lifting off the throttle in 2nd and 3rd gear.