

DIY Advanced Ignition Diaphragm (AID)

By Noel Simmons (aka Notnoel on Saabnet)

This hack grew out of some of my earliest dives into the Saab 900 performance world. At the time, there was an AID that had formerly been available from Dave Kennedy's Group 9 Performance (Saabnet ID: 900aero), and I had been his and Jak Stoll's posts reading how the stiffer spring in the Group 9 AID was required to gain a more linear retardation of spark as boost increased. The stock spring was too weak and would move the timing from 16-18 degrees to the desired 10-11 psi as soon as boost hit 5-6 psi (all or nothing). This resulted in a substantial flat spot in the response; the spark would be over retarded from 6 psi until about 16 psi. This in turn, messed with the APC which was just beginning to do its job (6 psi is base boost). What was needed was to make the retardation curve linear – gently increasing in retard as boost is applied until you hit the limit of the arms movement (around 16-18 psi).

The Group 9 solution was to cut open the capsule and replace the spring inside. That approach necessitated machine a "jacket" that fit back over the capsule to seal the two halves together. It was a great improvement over stock and hats off to them for figuring this out. Unfortunately, the market for these was small, and they could only be bought (rarely) on Ebay. I figured out a way to achieve essentially identical results by adding a small spring to the actuator arm (got the idea from an old fashioned fisherman's spring scale). Here is my original post from Saabnet:

Thanks to Jak, MS, and 900 aero! Just installed my modded capsule and it works like a charm! I drilled out the stop and modified it as described elsewhere. Then drilled a hole in the top and bottom of the mount to attach a small rod parallel to the capsule (to attach one end of the spring to). I then drilled another small hole in the actuator to attach the other end of the spring to.

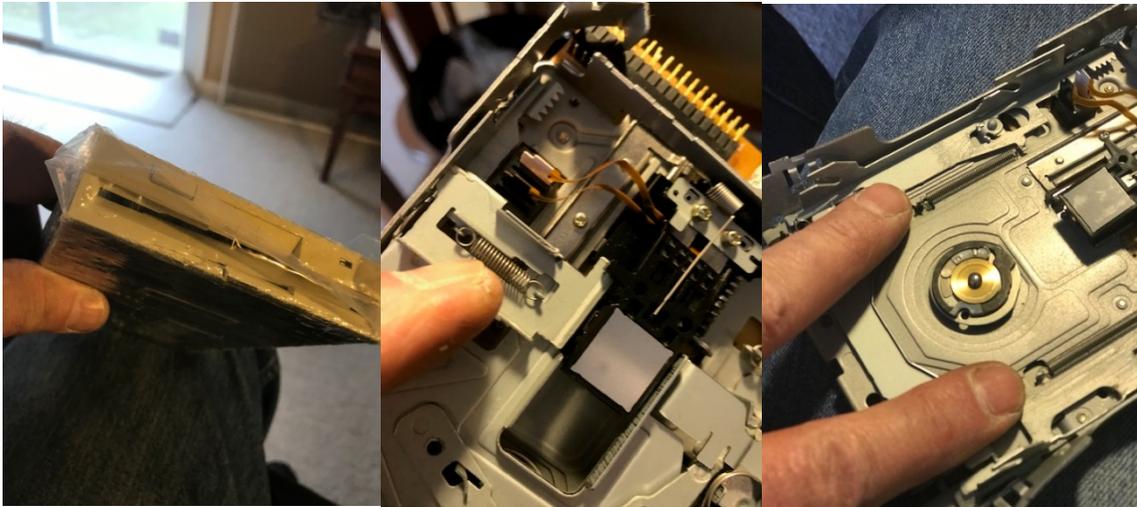
For the springs, I cannibalized an old 3.5" disk drive. These springs are stainless steel and about a 1/2" long and a 1/16" in diameter. They are pretty stiff and design to work under tension (to pop the disk out of the drive). I slipped my thumbnail into the spring and stretched out the end of the spring I planned to discard, cut off the excess, and bent the end into a hook. Next I attached the hook to the rod and the hole in the actuator arm so that the spring was under slight tension.

Next came bench testing using my boost gauge. Turns out one spring did not provide enough tension, so I added two in parallel. Under this set-up, the actuator began to move at about .2 bar and closed the stock gap at about .4 to .5 bar. I determined that the springs could only go on the underside of the actuator arm due to clearance issues. Since the modified gap of about 2 mm is twice the stock, it seemed like I was pretty close to where I wanted to be. So I modified the retard stop to an adjustable cam, set it for about 2 mm and tried my bench test. It hit the stop right at 1 bar, so I installed it in the car.

I set the timing at idle at 20 degrees, hooked up the gauge and vacuum hose and began incrementally pumping up the simulated boost. The timing retarded smoothly beginning at about .2 bar and landing at 10 degrees at 1 bar just as in the bench test. Nirvana on the test drive.

The note in the first paragraph concerning “the stop” refers to a cylindrical part of the capsule’s actuator arm that is riveted onto the housing for the capsule. Another hack for the capsule is to remove this stop, grind one edge down to a cam, and then put it back on using a set screw so that the full boost timing can be set to 10-11 on the car. I did that too on my prototype, but it is not altogether necessary; it is easy enough to put torx or Allen wrench into the rivet and simply bend the stop one way or another to make this adjustment as will be shown on the bench scale instructions in a moment. To do this hack you need 1/8 and 1/16 drill bits, a 1/8” Allen wrench you are willing to sacrifice to the performance gods (or a small nail will do), a pair of needle nose pliers, some epoxy to hold things in place, a Mity Vac to pump up simulated boost, and most importantly, a tiny very strong spring. The spring you need is easily scavenged from a now obsolete disk drive. Here are step by step instructions for the capsule modification:

- 1) Obtain an old 3.5 inch floppy drive and tear it open. There are three springs in there you can use: 1 short one and two long ones that can be cut in half. The short one is perfect!



- 2) Using a 1/8 inch bit drill a hole parallel to the body of the capsule across both sides of the sheet metal mounting bracket; this hole needs to be on the same side as the half of the capsule where the vacuum line attaches to the capsule (see photos below). It is very important that the spring assembly be on this side so that there is enough room to put the capsule back onto the distributor. If you try to install the spring on the other side, the assembly will not fit through the opening. The 1/8 Allen wrench slides through this. You will be attaching the spring to the Allen wrench.
- 3) Using the 1/16 inch drill bit drill a small hole in the actuator arm and center the hole at the center of the stop. You will be attaching the other end of the spring to this hole (see photos below)



- 4) The small spring salvaged from the floppy drive is the perfect size. Deform one end of the spring from a circle into a hook using the needle nose pliers. Next slide the other end through the Allen wrench and slide it down until it is parallel to the actuator arm. Then work the hooked end into the small hole you drilled in the arm using the pliers and make sure the hook holds it firmly in place. If you mess up bending the hook, you can make up a new spring from either of the two long springs (you want a spring length of $\frac{1}{4}$ to $\frac{3}{8}$ of an inch).



- 5) At this point you are done with the fabrication and need to test it before applying a dot of epoxy on all of the connections. I have a positive pressure gauge I added to my Mity Vac, but you can also use your boost gauge by disconnecting the vacuum line under the hood. The vacuum line can be attached to the Mity Vac and the capsule using a "T"-shaped connector.
- 6) Pump up the capsule until the notch on the actuator arm just touches the stop on the capsule and check the pressure reading on the gauge (my initial try had this

happening at 0.5 bar (8 psi). Insert a torx or Allen wrench and bend the stop “up”, away from the capsule. Keep adjusting it until the arm reaches the stop at 16-18 psi (that’s the full; reach of the capsule. Depending on the nature of the spring, you may need to shorten it to get the desired range of movement.



- 7) Once calibrated, you just need to put dabs of epoxy on all of the connections. I like 5-minute epoxy for this job.



- 8) After the epoxy sets for a few hours, reinstall it on the distributor, put it back in the car and set your idle timing (I like a slight advance 18 degrees). You can test it to verify it is working by using the Mity Vac to pump up the capsule and monitoring the results with a timing gun: the spark should retard to 10-11 psi at about 1.0 bar of pressure. Follow the Group 9 adjustment procedure (attached at the end of this guide).

Then go out and enjoy the drive. You'll find a much more responsive acceleration and a less laggy boost performance.