

# 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.*

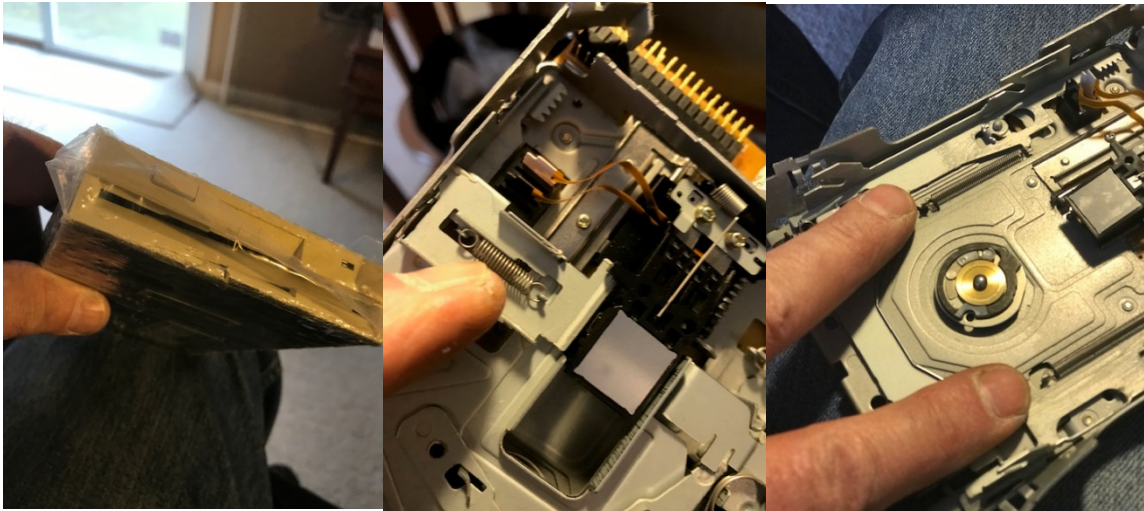
*For the springs, I cannibalized an old 3.5" disk drive. These springs are stainless steel and about a 1/2" long and a 1/16" in diameter. They are pretty stiff and design to work under tension (to pop the disk out of the drive). I slipped my thumbnail into the spring and stretched out the end of the 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 a 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.

**Subject:** Re: Group9 AID  
**From:** Dave Kennedy <lesco-saab@thegrid.net>  
**Date:** 9/11/2015 7:15 PM  
**To:** noelsimmons@verizon.net

Hello Noel, I found 2 so I'm sending both of them!

Take care, Dave

**The A.I.D. installs with basic hand tools and is a direct replacement for the factory ignition distributor diaphragm.**

**If you have not done a distributor diaphragm replacement before, follow these steps:**

- 1. It's a good idea to check and note the initial ignition timing setting with a timing light before replacing the diaphragm just to know where it was to start with, the factory recommended setting is 16 degrees Before Top Dead Center (BTDC).**
- 2. Of course allow the motor to cool down until you can touch the distributor without discomfort if the engine has been run recently.**
- 3. Unclip the distributor cap and move it out of the way. No need to disconnect the plug wires.**
- 4. You do not have to remove the distributor from the motor. Remove the two screws holding the diaphragm unit to the distributor, noting the location of any ground wire and the one distributor cap retaining clip that's held on by one of the A.I.D. mounting screws.**
- 5. A hole in the end of arm of the diaphragm unit slips over a pivot pin inside the distributor. Gently wiggle the diaphragm while pushing it sideways towards the motor, when you feel it come off the pin just lift the old diaphragm assembly up from the distributor. The pin is mounted on a movable plate that rotates back and forth a short distance. This is what causes the ignition timing to change so if this plate with the pin does not move freely the distributor will need to be serviced to correct the problem before proceeding further.**
- 6. Now comes the trickiest part of the installation! Getting the eye at the end of the A.I.D. arm to slip over the pin (and stay there!) on the advance plate. You are flying blind here as you cannot see the pin you are aiming for after you move the diaphragm unit into place on the distributor. Before holding the A.I.D. up to the distributor with your right hand using a small pocket screw driver or**



equivalent in your left hand reach through the open area in the distributor and lift up on the pin rotating the movable plate so the pin is at it's highest point. Then with the same small tool hold the plate (pin) steady at that position while fishing and hooking the pin with the A.I.D. in your right hand. You can tell you've got the arm over the pin by gently lifting the A.I.D. up and down. My little A.I.D. installation trick is, once you have the pin hooked is (pull up and away from the engine to make sure) to gently hold the diaphragm unit away from the engine while putting the mounting screws back in. I say screw(s) because I install them both even though one has to be remove afterwards to put one of the distributor cap clips back on. I do it this way so the damn thing doesn't come unhooked while fussing with that one distributor cap clip

7. As a final check to make sure you have the arm on the pin, try to move the reluctor pickup through its normal travel. If it still moves freely the diaphragm arm is not on the pin on the advance plate. If this is the case remove the A.I.D. and try again. The first time you do this is the most difficult.

8. Install the distributor cap and attach the retaining clips and any wiring disconnected previously.

9. Recheck initial advance timing and adjust as necessary. The A.I.D. is calibrated to allow 3-6 degrees more initial advance as we recommend to go from 16 to 19 at sea level and our Saab friends in the Denver Colorado area that's over 5,000 feet run as much as 22 degrees BTDC .Optimum ignition timing within reason should be determined by road testing.

10. Fine tuning if necessary? What we ended up doing to make these units adjustable without raising the price was to include a little tool that fits in the rivet looking end of the stop that you can easily get to for final adjustments as necessary. Just reset the timing to 19 -20 BTDC and then apply pressure with a mityvac hand pump to the A.I.D. and see what the timing light reads while simulating boost pressure of 15 to 20 psi. If for instance you set your timing at 20 and the A.I.D. backs it down to less than 10 degrees (BTDC) which may be too much (aim for 10 if starting out at 20) so insert the tool and gently push down slightly bending the stop up on it's other end which will decrease retard and of course gently lift up on the tool if you need to go the other way.

The old ignition diaphragm comes off easily but it's a little tricky to replace. I do it with the distributor still on the car! Remove your distributor cap so you can see what's going on inside and use a small screw driver or equivalent to hold the

*I use a  
an Allen wrench  
for this. Just find  
one that's a tight  
fit.*

breaker plate clockwise from the front of the car while sliding the A.I.D.'s arm over the pin in the breaker plate. Hold the unit forward towards the radiator and gently lift up to make sure you've actually hooked the pin! While still holding it forward move it down into place and install both screws without the rotor cap clip as it's hard to do all that at once. Then suck and blow on the hose to the unit and looking behind the dust cover make sure that the breaker plate is in fact moving in both directions. Now with one screw tight you can remove the other screw to replace the distributor cap clip. Then replace the cap and reset your timing to 20 to 22 degrees before top dead center. While the timing light is still in place simulate 20 psi to the unit with a mityvac or bicycle hand pump and see if it retards to 10 degrees + - 1 degree BTDC. In other words with the simulated boost pressure it should retard back to from 9 to 11 degrees BTDC. If it only retards back to say 8 degrees BTDC insert the pin like object into the hole in the rivet (opposite end of the retard stop) above the lower attaching screw in the A.I.D. and gently lift up with your forefinger on it with the engine running and the timing light still in place and you'll see it retard. You'll see that as you lift it the timing light will react but go back right where it was so you have to lift it enough extra to get the retard to where it belongs. If it happens to have too much retard you push down on the pin like object. I get the units so close when I machine the A.I.D.'s actuator arm in my mill that this is something you don't have to worry about right away, just set your initial timing to from 18 to 20 degrees BTDC depending on your altitude.

On 9/11/2015 2:10 PM, [BulletinBoard@saabnet.com](mailto:BulletinBoard@saabnet.com) wrote: