Orientation of the hole in a spray bar

In the June 1982 issue of *Model Aviation*, I wrote the following in my CL Racing column. Now, 30 years later, the topic arises time and time again: what is the ”best “ orientation for the hole in the needle valve body relative to the flow of air through the venturi? Perhaps the following echos from the past will help.

Regards,

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Recently I read an item in one of the specialty newsletters that claimed some fantastic gains could be made in the ability of a venturi/needle valve to draw by placing the hole in the side of the needle valve body in a particular position relative to the throat of the venturi. Since some of our racing events require suction fuel systems, I decided that I would see if I could duplicate the numbers given. Well, I couldn't. Upon investigation and a talk with the author of the item, I learned that the numbers he had printed were incorrect but that *some* gain could be had. But how much?

In order to measure this effect, two test items were needed: a reliable source of suction to draw air through the venturi, and a means of accurately measuring the draw created on the needle valve. The first item was provided by a piece of rubber hose of about .325 i.d. into which the venturi was inserted. This was then attached to my shop vacuum so that a *portion* of the air inlet to the shop vac was through the rubber hose. In order to measure the draw of the needle valve/venturi, I rigged up a water manometer. This is a simple device that any high school physics class can explain. It was made from a length of large diameter polyethelene tubing that I bought at a hardware store. (I suppose a piece of fuel line would also work.) This tubing was about four ft. long and was mounted to a board in the shape of a "U." I filled the tubing about half-full with water and noted that the level of the water was the same on both sides of the "U." I connected a piece of fuel line to the top of one of the legs of the "U" and ran it to the needle valve inlet. As I drew air through the venturi with the shop vac, the water in the attached leg of the manometer rose a certain amount. With this setup, you can measure the effects of such things as venturi size, shape, and (as we were doing here) the effect of where the hole in the needle valve is in relation to the throat of the venturi.

In my testing, I clamped the venturi (I was using a K&B venturi) in a vise on my bench so that I could rotate the body of the needle valve while the shop vac was running. While rotating the body I could watch the suction being created on the needle valve by watching the level of the water in the manometer rise and fall.

I got some interesting results. With the hole in the body pointed straight downstream, I observed a vacuum on the manometer. As I rotated the body through about 90°, I found that the draw on the needle valve changed very little—as long as the hole in the body was anywhere downstream from perpendicular to the venturi throat. But as I rotated the body so that the hole was right at 90° to the air flow, I found a very small area where the venturi action on the hole in the needle valve increased strongly! Using a K&B venturi with a .375 throat, and a K&B universal needle valve assembly, I found an increase in draw of 13.6%. Then I tried a K&B venturi with a .345 throat and the same needle valve assembly and found a 16.2% increase.

Now what does this all mean? In those events which require a suction system, it might mean the difference between being able to draw fuel through a given venturi or not. Or it might mean being able to use a larger venturi for more power! In any case, it is an advantage to be used.

How do you go about getting this advantage? I believe you will have to do it by setting the needle valve body position in the venturi in the same way I did in my testing. I found that the additional draw appeared in a very small rotational angle, and I doubt anybody would be able to hit it "free hand." Once you get the needle valve body into the venturi and rotated to the point of maximum draw, you should tighten it down good, recheck the position, and then *leave it alone!* When installed in the engine, you should be getting the maximum draw the venturi is capable of producing.

One other item I found interesting was the comparison of the draw of the .375 vs. the .345 venturi. I believe the venturi shape is the same since they are both factory stock units, and they certainly look the same to the eye. The .345 venturi has a 29% smaller effective cross-sectional area with the K&B needle valve than the .375 venturi. The difference in drawing ability was nearly 45%! If I hadn't made the test and read the answers myself, I would never have guessed that there would be that much increase. Learn something new every day. The next effort will be to try and evaluate some venturi shapes. If anybody out there has some pet ideas or theory that they would like to share, let me know, and we'll give 'em a try.