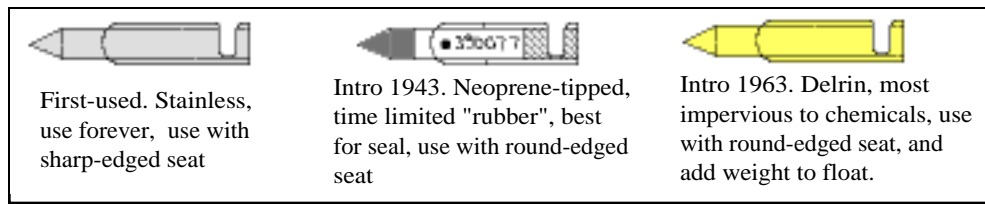


Stromberg Carbs: Needles Leaking, Safe, Or Take A Chance?

Neoprene/Stainless/Delrin needles for the C-85 and C-90 engines (NA-S3A1)



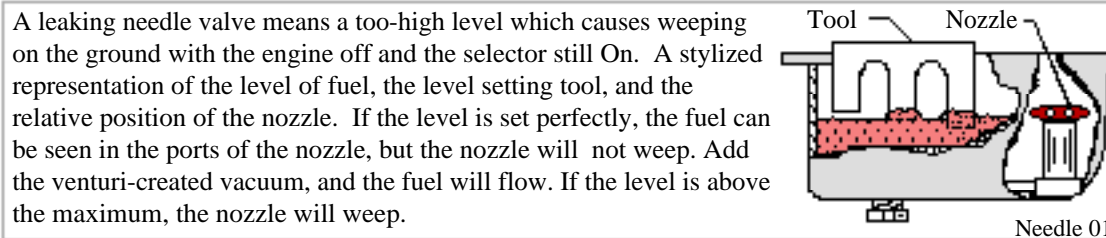
Kudos to the EAA and Harry Zeisloft!

Harry Zeisloft is the person who led the work on getting us the STC's for using auto fuel while he was affiliated with the EAA for that purpose. Not long after people began shifting to the auto fuel, some experienced trouble because their mixtures were too lean and the problem was traced to the swelling of the "Neoprene" tips of the needles. Zeisloft issued an alert, and the FAA mentioned it but did not issue an AD. Nothing seemed to be absolute, though, because many with the Neoprene needles in their Strombergs had no trouble and continued to use them. Some people, having changed from the Neoprene-tipped needles to the older stainless or Delrin because of the notice, were bothered by the drooling leak since neither the stainless or the new Delrin (a hard plastic) needles would seal as well as the Neoprene. They elected to go back to the Neoprene tip type and are still using them today.

The solution of whether or not to use them seems to be related to where in the country you are when you buy fuel for the plane, which fuel, and the quality of the Neoprene tip. Wanting to know more, we did some experiments.

Caution:

Life was simpler when the auto fuel experiments were done; fuel was simpler and more uniform, and lots of things have changed since then. Many states now allow the use of additives such as ethyl alcohol which can have some very strange effects on some of the Neoprenes used in the needles. If you still use the Neoprene needle in the Stromberg carburetor for the C-85 and C-90 engines, heed the hazards noted in this note.



Needle genealogy:

For the first Continental engines using the Stromberg carburetor, the material for what would prove to be a long-wearing needle was made of stainless steel. It worked. Sometimes it did not leak and sometimes it leaked so fuel would overflow via the nozzle so as to deplete a tank, but pilots learned to run with the selector Off on shutdown until the engine quit and to make sure the selector was Off all the time except when the engine was running.

Sometimes we have to be reminded: we didn't always have Kleenex or TV and Neoprene was not available for civilian use until after WWII. It was a magic cure which stopped the carburetor leaks "forever". Forever lasted a long time, the end being the drastic changes in fuel blending, and some blends were found to cause swelling of some of the Neoprene needles and that eventually caused some engines to run so lean that they could not sustain flight. There was no way for the auto fuel STC user to determine which fuels were safe with his brand of Neoprene needle.

Not all of the Neoprene needles were made by Stromberg/Bendix ; those third party suppliers did not use the original Neoprene “flavor” and therein lies the biggest risk. With those made by third party companies, some fuel additives could cause immediate and irremediable damage to the needle, with bad effects on a running engine.

The Bendix Service Bulletin #71, issued **8-24-1943**, specified the change to the “new” Neoprene from the stainless needle, and added that a round-edged seat was to be used with the Neoprene-tipped needle instead of the sharp-edged seat for the stainless steel needle. The stainless needles could be used until “present stocks are exhausted” and that explains why, 50 years plus after the change, you can still get the stainless needles!

The Bendix Service Bulletin #84, dated **26 June 1963**, was issued to introduce the Delrin needle. The reasons were to remove the necessity for tracking the rubber age control requirement, reduce cost, and provide a longer-lived material. Note that this is long before the change in fuels which is given as the reason for the change to the Delrin needle. At the end of the article is a bit more of the Bulletin and you can see why Bendix made the change. (The die-made Delrin would be of a consistent size, require zero machining, and last a long time so it was cheaper and better for Stromberg.)

Our tests:

Be aware that all of the tests we did were done in California, using fuels legal here (all without damaging alcohols in them). Where you live, the rules about fuel blends in your state, and how and which and when alcohols are used in the fuels can make a terrific difference. You are your own experimenter and no one will help you pay for any damage if you continue to use the Neoprene-tipped needle which is sensitive to unique fuels!

The “hangar tales” about Neoprene/stainless/plastic needles for the Stromberg get a bit confusing. When there was the big scare about the swelling needles, I asked International Cessna 120/140 club members to send me their old Neoprene needles so that I could evaluate them. We found at least some of what was fact and what was “scare”.

I took the Neoprene-tipped needles and put them in 100LL for several weeks. Then, I did the same thing with the needles in “normal” auto fuel, 87 octane. Having measured them before and after the immersion tests, there was not an iota of a difference...but...like all stories, the portion left out is that not all gas is devoid of the constituents which could cause swelling. Note that, by law, all aviation fuel is supposed to be the same, with no state-sanctioned alterations allowed but that is not so for auto fuels; there was no way to tell which blends gave problems to some members.

Alcohol or other enhancers in the gasoline can cause a swelling and weakening of the rubber-like Neoprene material. When I placed the needles in some readily available alcohols, it was incredible how quickly SOME of them changed shape and how the previously stable material became very easy to abrade and wipe off. (I was astounded when I immersed the needles in denatured alcohol for a few minutes and saw the change on some, the others untouched.)

Physical differences:

Digging deeper, I did a microscopic observation of the various needles. To make it easy, what I found was that there were “good” needles, those made by the good people with the correct materials and those who wanted to make a buck and weren't choosy about what the material blend was. Bendix/Stromberg and the other owners of rights to manufacture the Strombergs did not label or otherwise identify which ones they made so there is no identifier to indicate which are good and which are poor. All “Neoprenes” are not the same and some from the fly-by-night outfits used blends of Neoprene which proved to be of poor quality with regard to the imperviousness to the “enhancers” in the fuels. Some states allow alcohol in auto fuel, some states allow other enhancers in auto fuel. One full load of the wrong fuel can do an amazing change to the Neoprene needle if it is made of the wrong blend.

Changes and Cures:

The Neoprene needle was matched with a seat quite different than the seat used with the stainless steel needle in that the surface which mates with the tip is radiused so the probability of a seal is maximized. What happens when the needle tip of Neoprene changes shape? There is a very limited movement vertically of the needle from when it is seated (when the level is to the upper limit) to when it is full open when the

engine is going full bore. If the Neoprene swells, then the annular channel between the needle and the seat is drastically changed in both the radial direction and the vertical direction, quickly limiting the amount of fuel that could pass at full open. Whereas full open with a perfect needle allows more fuel to flow into the carburetor than the engine is using, a swelling needle will eventually allow only just enough fuel replacement to taxi, run the engine up, maybe even allow takeoff and some flight when the needle is fully elevated from the seat. As the swelling increases, the fuel flow allowed decreases even more, with the “starvation” effects noted by some of the owners.

There are those who changed from the Neoprene to either the Delrin or the stainless who were less than pleased with the drool after shutdown. My plane initially had the stainless needle, drooled, was changed to the Neoprene-tipped type and it served admirably for years. Even though we here had no problems with swelling, I went back to stainless after all the notices by the EAA as part of the auto fuel experiments. I simply shut off the fuel when close to my parking place and let the engine die by running out of the fuel in the carb, so no drool. A few years after the issue of the Delrin needle, there was acknowledgment about the fact they would leak and so methods to reduce or stop the leaks were offered, a point missed by most who thought the Delrin was supposed to be as leak-free as the Neoprene type.....again, see the comment of “why” at the end of the article.

Some people who had the Delrin or stainless needles found they had leaks and didn't want to shut off the selector or would forget, so they went back to the Neoprene and have stayed with it and have had no ill effects...but this state has a law against some of the adders in other states which make the fuel attack the needle materials. The thing is, there are those owners who have the high quality Neoprene needles, who live in states that don't allow the deleterious materials in the fuel, and who don't go to states where the bad stuff is allowed. As long as the symptoms and risks are understood, you can use the needles made with high quality Neoprene but understand the risks and realize that the “bad blend” might be out there.

Lessons learned:

If you use the Neoprene type, never trust that the fuel you buy today is the same as last week! Refiners have latitude as to which enhancers and which blends they use. No one!! has ever or would ever be able to ascertain which blends are “safe” for use with the Neoprene needle and which are not. Here in California, we were assured by 4,000 labs and 20,000 state commissions that MTBE was a great enhancer to fuel as a replacement for the last lead used in auto fuels. Trillions of gallons later, the same non-apologetic commissions and labs are claiming that the great additive can cause cancer, is poisoning our water, and we are now paying doubly to get rid of the “safe” additive. No one yet knows what the “faultless” new adder will be in the future fuels.

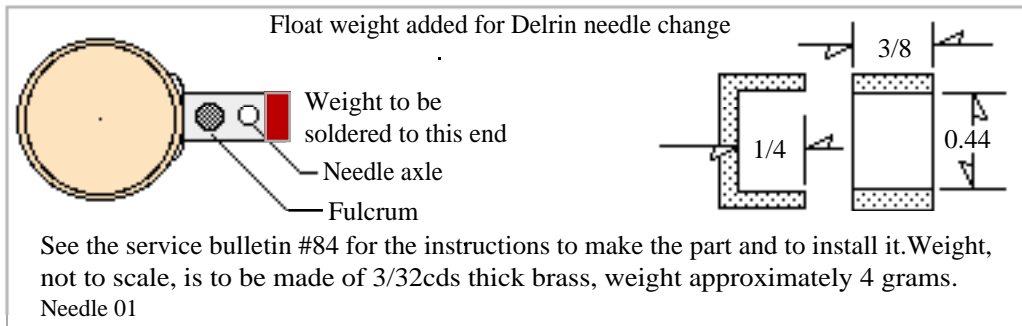
For the stainless needle, the advantage is that it can withstand any fuel blends, even the pure alcohol we are threatened with once in a while. There are those who have the stainless and who had the drool who were either able to halt it or cause it to decrease by lapping the needle. You can certainly try lapping it, but understand that lapping by rotation of the needle in the seat is going to depend on luck, because the needle never rotates when in operation...it just goes up and down and making the actual sealing portions mate exactly is difficult. Many who don't know history are unaware of what a great benefit that Neoprene was in these applications; Neoprene, when developed during the big war, was “magic”. Be sure that you have the seat which is meant to be used with the needle....many have been wrong forever or since the last change, so don't assume that it is the correct one just because it has been “working”. Verify!

The Delrin replacement needle is not as compliant (soft) as the Neoprene, so it too will often leak when the airplane is left sitting and the selector On. Some owners state that they have lapped those to the seat and satisfied themselves with the results. They used valve lapping compound (see the callout at the end for the Bendix-Stromberg sanctioned lapping compound). Some with the Delrin needles do what we did with the stainless....shut off the fuel as you approach the parking place and let the engine die of fuel starvation and leave the selector Off until the next start. Oddly, that action has been a favor for some because they learned in that way that their selector was leaking (as well).

The important points have been listed. If you always know about your fuel, you could use the Neoprene close to home....if you have one which was made by the good people, there seems to be no swelling whatever if used with “safe” auto fuels....the stainless often needs to be lapped if you want to stop a seep when on the ground, but it doesn't always work because the needle is not restrained or guided to exactly the

same position on the seat. Some who have opted for the Delrin needle state that their leaks have stopped when they lapped those, so that is an option as well.

The price of the plastic needle was, for a while, truly outrageous, having risen to \$140 soon after the problems with the Neoprene were found (\$76 now at Spruce). For peace of mind and the freedom to ingest any fuel anywhere, in any state, the stainless and the Delrin are the best. Neoprene needles are still available, they are the cheapest, but there is no way to know if they were made of the correct blend of Neoprene, made by the good guys. The later sketches might assist in the determination, at least as an indicator of which to not use. You are on your own with the Neoprene.



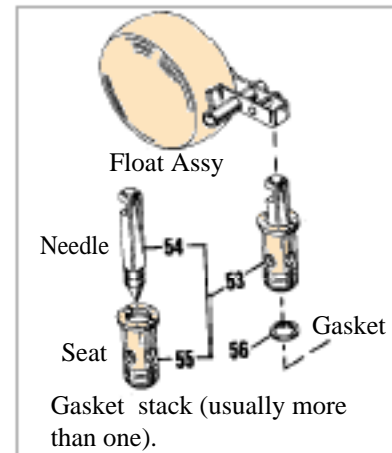
Recently, an Ercoupe owner had an engine failure during landing and ran into power lines near the end of the field; it was found that when the change was made to the Delrin needle and the weight required was added to the float, the weight or the solder to hold it on got hung up on the carburetor body, flooding the engine with full fuel flow, rendering the engine unable to develop power.

Seat:

Not everybody knows that the needle must be matched to the proper seat...if the wrong seat is used, then the size of the openings between the needle tips and the seat is changed drastically and that mismatch could cause problems. The probability is high that many have the mis-matched seat today because they changed only the needle. It “used to be” that the sellers and the mechanics working on the carbs knew the difference, but that is no longer true. There are sharp-edged seats and rounded/radiused seats. Make sure that your seat and needle are matched! For example, Aircraft Spruce is presently the only catalog I know of that lists the Neoprene needle....but they make no mention that a particular seat must be used with it!! They also sell the stainless needle but not the seat and no set is offered and they sell the Delrin but today only mention that it exists and to ask for it and they don’t mention that a rounded seat must be used with it. Make sure yours are matched as the maker expected.

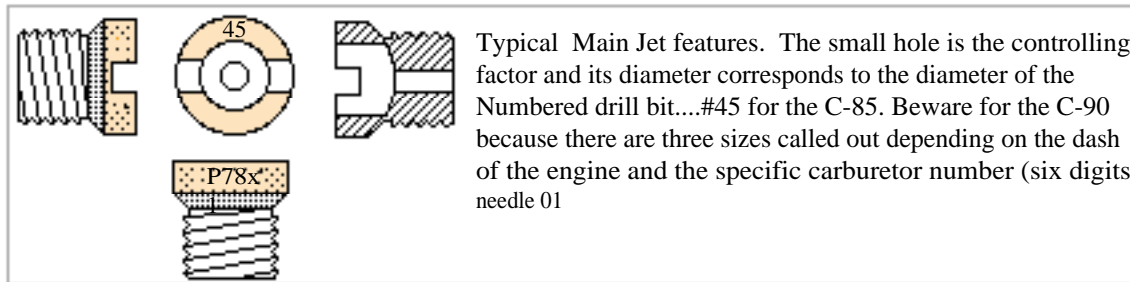
Level story and tools:

Other things. The tools you can make for adjusting the level of the fuel in the carburetors (and you must do this if you change needles and/or seats!!) are shown in the article starting page 8 of the August 1998 issue of the Vintage Airplane magazine (EAA Antique/Classic Division and thanks to the editor H.G. Frautschy, the figures are excellent, much better than mine). The “tricks” to setting the levels are in that article, too. The same articles were printed in the International Cessna 120/140 Newsletters and copies of back issues can be requested.



Note..one old hangar tale is that the gasket between halves of the carb must be wet with fuel all the time. Nonsense. The fuel level, when properly adjusted, does not! reach the gasket so anytime you see a wet gasket, the body-gasket-body seal is poor and/or the float level is too high! To know for sure on the ground, see the article on adjusting and the tools to use. If the carb gasket is wet, fix it.

When you and the A&I are in the carburetor for these inspections or changes, make sure that you verify the number of the main jet as well as the size of the hole in the jet; #45 for the C-85 and a different size for the C-90 (careful...the C-90 uses a #46 and the C-90-14F uses a #44 and another 90 uses the #45). We have found that owners? have changed the main jet for reasons unknown and did it without a logbook entry so don't use those as a guide. These numbers are impression stamped in the top surface of the seat as the sketch indicates. The number, by the way, corresponds to the numbered drill bit whose shank diameter will just fit in the hole. Owners have been known to increase the hole diameter to "make something better" and that tidbit is not in the log either. If you see even the tiniest burr inside the Main jet or on the edge of the small hole, get a new one.



Typical Main Jet features. The small hole is the controlling factor and its diameter corresponds to the diameter of the Numbered drill bit....#45 for the C-85. Beware for the C-90 because there are three sizes called out depending on the dash of the engine and the specific carburetor number (six digits) needle 01

Gaskets:

You always need a new set of gaskets any time you overhaul the carb or just change the float, the needle, or the seat; they are used not only under the mixture plate but combining various thicknesses of gaskets under the seat is how you adjust the fuel level and of course you need new gaskets between body halves, between the carburetor and the induction spider, and between the carburetor and the air box. Most gasket sets have all of them and the latter two are available independently from the catalog houses such as Aircraft Spruce.

Service Bulletins:

The Bendix Service Bulletin #71, issued 8-24-1943, specified the change to the "new" Neoprene from the stainless needle, and added that a round-edged seat was to be used with the Neoprene-tipped needle instead of the sharp-edged seat for the stainless steel needle. The stainless needles could be used until "present stocks are exhausted" and that explains why, 50 years plus after the change, you can still get the stainless needles!

Also, the SB mentions: "do not use a sharp-edged seat with the Neoprene-tipped needle because doing so will eliminate the possibility of the needle sticking in the seat or being cut by the seat". (Kind of a backwards statement....where what was meant was.....don't use the sharp-edged seat with the Neoprene-tipped needle or it might stick or be cut.

The information in service letters of old were rather sketchy, before the many lawsuits, and the writers expected the mechanics to be able to think. Although they do not mention it, the mechanic should be able to figure out to remove the weight if he changes back from the Delrin to the stainless or the Neoprene-tipped needle! Unfortunately, Bendix/Stromberg made an error by stating that the carburetor did not have to be re-marked for any of these changes, so you can't tell from the outside what is inside.

In 1971, the information in the carburetor section of the 140A manual, states: When the Delrin needle is used, slight fuel leakage at the needle and seat may be corrected by lightly burnishing the needle in the seat or the needle and seat may be lapped using "Timesaver" Soft Metal Lapping Compound (yellow label).

The David L. Cheek's Delrin lapping solution:

David L. Cheek's Stromberg started to leak. As a replacement, he tried lapping a used stainless (the original, before Neoprene-tipped) needle and its matching seat but had the same drool, and then tried a new Delrin needle in the old seat, but it leaked. He tried lapping the Delrin.....was told by an El Reno grumpy "expert" that: "nobody could make them not leak, so just live with it....." but he ordered a new radiused seat to match with the Delrin needle anyway (\$80 plus the \$75 for the Delrin needle) and this is what he did with the combo.

His leak test, using just the seat and needle, is to invert the assembly, holding them together with his fingers and then applying mouth vacuum to the bottom of the seat. If the needle stays in while hanging down with no support other than the mouth vacuum he knows he has a good seal. His story and now ours.

Neal.....I think I'm onto something! I get a good suck test on the Delrin needle with new seat--only after considerable massaging of the two parts. I started lapping with the finest thing that I had around, which was Simichrome polish. My wear marks showed a good seat pattern on the needle. As soft as the Delrin appears, I think that the brass laps faster than the plastic. (My comment; we underestimate the characteristics of material which yields. In this case, the Delrin captivates the abrasive and holds it without cutting itself as much as the particles now held cut the brass of the seat.)

I have a good strong magnifier to look at the parts, and saw that there were considerable machine marks still in the seat. However, I think that the biggest problem is that the plastic tends to "fuzz up", even with the polishing compound that I was using. Close inspection with my glass showed the nice wear pattern to be slightly fuzzy, and not smooth and even. It is like trying to sand on plastic with sandpaper, which will not leave a clean finish.

I could not get a good seal after this lapping. When I put a very fine drop of oil on the tip and tried the suck test, I got a perfect seal. I knew that I was getting close. I then switched to fine scratch remover (Novus #2 from A/C Spruce, or several other suppliers) plastic windshield polish. The fuzziness was still on the needle, but getting better. My suck test results were getting better, even without a drop of oil. I started thinking about what I might have around the house that would polish finer than the plastic polish.

Then I remembered that my wife's 1966 Dodge Dart convertible had a new top put on it last summer. I asked the shop that did it what would be a good cleaner for the clear plastic back window. I was surprised at the answer.---Mayonnaise! They said it is slightly abrasive for scratch removal, and that the oil in it helps preserve the plastic. I put some on the needle and proceeded with the lapping again--(by this time well over an hour has gone by).

The needle had a dirty ring around it at the seat contact when I started. After working it with mayonnaise a few times, my glass inspection found the fuzziness almost completely gone, and the needle squeaking in the brass seat, indicating that my seat was getting pretty good. I think the key to all this is to GET RID OF THE FUZZINESS, which may appear to be a good seat, but allows leakage.

I now can suck on the seat with the needle in it, and the whole thing will hang from the tip of my tongue for as long as I want. Isn't it amazing that something so simple and straightforward can be such a pain to get working properly?!

Thanks to David L. Cheek!!.....and mayonnaise!

David did a tremendous amount of work in measuring the radii and the shape of the needles and seats he had and that information will be developed into another technical note for the aid of those working on the Strombergs.

License owner:

The license owner for the Strombergs these days is: Precision Airmotive Corp (The Engine Division). 3220 100th Street S. W. Bldg. E Everett Washington 98204 They list nine affiliates around the country and 14 overseas, so a call/note to them would get you the closest affiliate if the factory is too far away from you. Their web sites, www.precisionairmotive.com and www.pacpac.com are extremely frustrating, but their phone numbers are there. One PAC company does Strombergs (Engines) and another company at PAC holds the license for the Marvel-Schebler.

New Delrin sets and seats from this source, according to a letter in the internet: "Skyport Services has needles, seats, gasket kits and copies of the Stromberg overhaul manual and sends along a copy of the Service Advisory as to how to install them. Ask for John at 1-800-624-5312" (Skyport was purchased by John and he has "our" plane, engine and Stromberg.) El Reno has both the needle (s) and seats or at least they did; the telephone answerer believes he is all-knowing, not kind, and will condemn the Stromberg, confirming his ignorance to each caller.

Aircraft Spruce has some parts, but they have to be asked since their catalog is poor on this page. (Gasket sets are available from Aircraft Spruce for about \$35 and they have the top and bottom gaskets as well.)

Bendix service bulletin:	Needle p/n	Seat	Seat p/n
71 steel 4-8-1945	P-14221	Sharp edged	P-17247 Last produced 1945, replace with matched pair only.
71 Neoprene-tipped	390077	radiused seat	383911, 383912, 384585
84 rev 7-15-72 for added weight to float lever	2523047	radiused seat, same as for the Neoprene-tipped	383911, 383912, 384585

Neoprene needles are still the least expensive, as if that will interest anyone (the Delrin is \$76, the stainless \$58, and Neoprene about \$1.50 at Aircraft Spruce but seats?...not mentioned though they may have them.) Aircraft Spruce does have the stainless needle and correct seat (this in October '01).

Source	Needle	Seat	Needle material	Carb/Engine
Bendix SB 30	P-14221	P-17247	Stainless Steel	
Bendix SB 71	P-14221	not noted	Stainless Steel	
Bendix SB 71	390077	383911	Neoprene	
Bendix SB 84	2523047	383911	Delrin	85-12
Bendix SB 84	2523047	384585	Delrin	85-12
Bendix SB 84	2523047	383911	Delrin	90-12F, 90-8F
Bendix SB 84	2523047	384585	Delrin	90-12F, 90-14F
EAA 8401	2523047	Not Defined	Delrin	
Assembly P/N for this combination:				
383943	390077	383911	Stainless Steel	

I wrote: I do not know what the difference is between the 383911 seat and the 384585 seat. From John C comes the information: the 384585 seat has a smaller orifice and is for pressure feed (for an engine using a fuel pump or two).

installations. 383911 is for gravity feed installations

Extra Stuff:

I have never seen what the rubber (Neoprene was called a rubber, synthetic) age requirement was in the Stromberg data sheets, but it was probably the same as for O-rings of rubber/Neoprene. It is likely that 99 percent of those in use are grossly in excess of the age limit! (Later, the age limit for O'rings was deleted.)

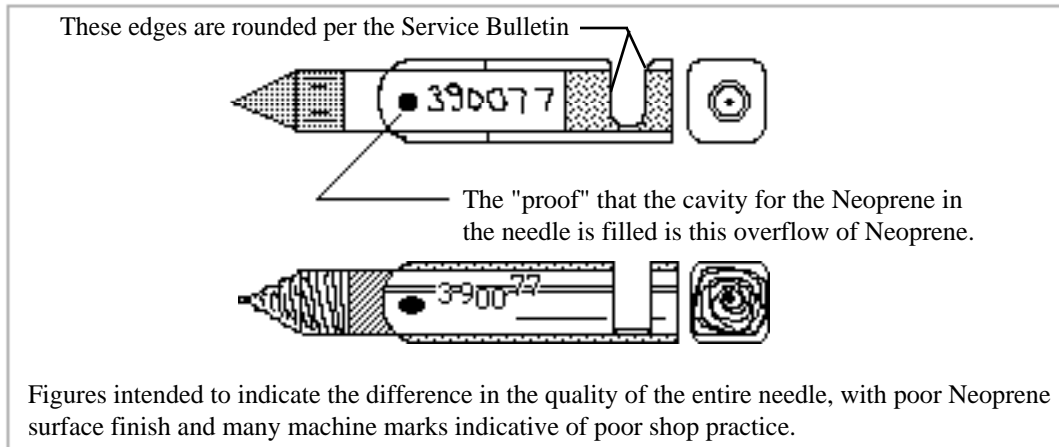
From the EAA magazine notice of 8401 12/15/1984:

“Bendix stated that they had not manufactured the Neoprene-tipped needles for 20 years plus. the Neoprene was of a higher grade when being made and should not be influenced by higher aromatic fuels such as 100LL or auto gasoline”.

Which confirms what I found, that all Neoprene-tipped needles are not the same, and only those made by the good guys are any good but they did not mark them so there is no way to tell which would be good and which would create problems. Soaking in fuel for a few weeks would though.

At the top in this figure, a Bendix? A Stromberg?? manufactured needle with a very smooth-surfaced Neoprene tip, as befits being formed in a well-made die. Even for those known to have been used for many years, there is no "wear" of the surface where the tip contacts the seat, simply an even smoother burnished area. The part number is usually etched with an electric pencil, and there may be an "A" on the front side. The surface of the stainless steel is smooth, usually polished, and lacks machine marks. The rectangular

trough where the float "axle" fits is made with a round-edged broach and the interior surfaces are smoothed. The end has a chamfered indentation indicative of good lathe machining practices.



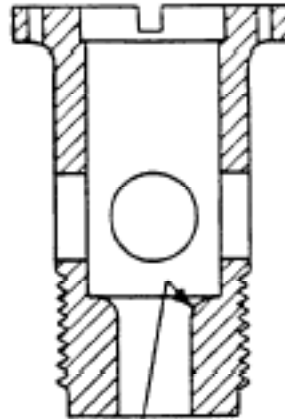
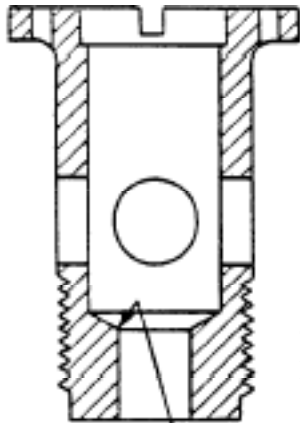
The bottom figure attempts to indicate the poor quality of a needle made by a less-competent source, probably without the sanction of the carburetor manufacturer at the time. The part number is impression stamped. The trough has a square (done by a cheaper broach) instead of a rounded interior. None of the edges are rounded or smoothed per the service letter or even when complying with good shop practice. The rounded edges and the round section of the stainless steel still show the marks of the dull lathe tool and none of the surfaces are ground or burnished like those we believe would be Stromberg-approved. The Neoprene is slightly off-center with respect to the center line of the stainless body.

All the features noted are symptoms of poor workmanship and non-compliance with the original design but the poorest feature is that the Neoprene has been shaped by a lathe tool, not in a smooth-sided die. Sealing with this surface would never be as good as for the one made with the smooth surface. The small teat of Neoprene is a further indication of poor workmanship.

Next, the addition of a picture of a seat (a good one, note the die-formed radii) and the relative shapes of the "sharp-edged" and the "round-edged" seats to allow discrimination when in hand since the parts are not marked with identifying numbers.

As recently as the summer of '04, a fellow owner received a mis-matched set of needle/seat from Spruce, something that could not have happened in the days when the sellers knew their parts. The warning is to not depend on the seller but do your own inspection immediately after receiving the parts.

Stromberg NA-3SA1 carburetor needle seats for C-85 & C-90 engines



These seat shapes used in the NA-3SA1 carburetors for the Continental C-85, and C-90 engines used in the Cessna 120/140's.

A

SHARP-EDGED SEAT
TO BE USED WITH
ALL-STEEL NEEDLES

B

ROUND-EDGED SEAT TO
BE USED WITH
SYNTHETIC-RUBBER
TIPPED NEEDLES

STROMBERG AIRCRAFT CARBURETOR SERVICE
BENDIX PRODUCTS DIVISION

Note: The drafted figures are from the source noted, drawn before the change to the Delrin needles. The B seat, with the radiused contact area, is also to be used with the Delrin needles. The sharp-edged seat is to be used ONLY with the stainless steel needles.

Filed as Seat pic & figures in SP

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Neal

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Filed as: Stromberg needles '05 (August, incorporated John C's)