What's the Best Pouch Sealant?

By Craig Brougher

If you would like to hear a heated discussion between rebuilders sometime in which no one learns anything and everybody walks away sure they're right, bring up this subject. I guarantee you will be thoroughly entertained. And the factor that always decides the argument in the mind of each is HOW WELL their sealant "seals." But it's a trick question.

"Why, the sealant I use is so tight that I made balloons out of pouch leather and tied them to sticks to decorate one corner of the shop with. And that was 5 years ago." I don't know what stories you may have heard (or came up with) yourself, but the fact is, the degree of sealant tightness is actually NOT the singular criteria of a good sealant, at all! But let's use our heads for a change and see if I am right, or wrong. After all, there's only one determining factor and that's performance.

There's also only ONE WAY to determine performance, and that's to make some fair and honest comparisons, right? Which means if you don't try different sealants first, then how would you know which is better?

But there are other variables such as the method the sealant used is applied, how it is thinned or put on straight out of the bottle or tube, if the leather is sealed first before the pouches are laid or if it is put on each pouch separately, the degree each pouch is dipped first, or if the sealant itself is used to wet dip the pouch, and how precisely even each pouch is sealed in turn when they are sealed separately, using, say, a finger, versus using, say a brush. You can think of all kinds of variables, for instance, the thickness of the leather itself, and if the comparisons came from the same skin (the only honest way to do it). These differences of course would completely change how that sealant would work and how evenly it would perform with each valve across the board. So let's cut to the chase now and easily answer these questions, because there IS a quick way to know.

First off, there are all kinds of players and their rebuilders, but most rebuilders are hobbyists who rebuild their own instruments, or at least partly. 50 years ago, rebuilding the valves was always an option, but that is no longer the case. Most players are 100 years old or pushing that figure, and thin leather, like pouches, dry rot. Sorry to say, if the player is going to play like a new one and last another 100 years, you have no choice but to replace them—not to mention the poppet facings. *That is no longer optional*. But the pouch is the speed control factor. Recoating an old pouch with more rubber cement,

for example, is simply cheating and it doesn't work. Nor will it extend the life of the leather, but DO NOT BELIEVE ME! I'll explain how to check that out. Believe that!

When you look at an old pouch that has been sealed with rubber cement, it will have been talcumed. You will also notice it has taken a "set." It's shaped. Dished down in the center and puffed up around the point of valve contact. On the other hand, the pouches which are not "grayish" in color and were not talcumed do not have the universal characteristic of a donut. *Now why would that be, but only for rubber cemented pouches?*

Simple—rubber cement gradually takes that set and then over the decades it gets somewhat stiff. That's what gives those pouches the donut shape. Once latex rubber takes its set, it begins to dry out and stiffen. Any kid that ever used something like Carter's office cement on porous materials like cloth and paper and wood know that their artwork didn't stay together very long.

Now there's a new kid on the block today, and basically, it's a latex plastic, such as acrylics and polyurethanes. These now are called "latex." Most often these are water soluble when still wet, and can be thinned. But back in the 20's the latex came from rubber trees and thinned with chemical solvents like naptha. So to add a modern latex to an old, dried out rubber latex is not just a waste of time, but will make the pouch worse for reproducers—not better. Why? Because "tight" is not necessarily better, and a "tight pouch" is always inversely proportional to a light and limber pouch! However, tightness is still important. So what are we talking about here? The DEGREE.

That said, I do not recommend unsealed pouches at all. All trackerbar valves, whether primaries or secondaries, should have sealed pouches. Here is how you can know if you are doing it right.

The Ampico reproducing piano requires by far the most sensitive and responsive valve because of its long, convoluted tubing runs, sometimes close to 6 ft. And due to the differences in tubing conductivity and air flow resistance, they were really pushing it by having the roll drawer so far away from the stack in the grands. So whether you were doing an Ampico or not, we'll use that system's design philosophy idea to test whatever valve we are rebuilding.

What is the most important characteristic of a note valve—sensitivity, or repetition? The answer is both, and that can only be tested at the lowest pressures and the longest tubing runs. This alone is a big problem for most people rebuilding players because they don't have a positive displacement test pump set up with a belt and motor that doesn't make noise, nor a regulator for it that can drop the pressure (vac) to a steady 4"

or so. Suction boxes don't work too well. That's because vacuum motors are centrifugal and VOLUME regulated, so their pressure is dependent upon two things—rotational speed and a supply hose throttle and bleed-- both.

The bellows pump produces roughly the same volume of air (within normal parameters) irrespective of its spill regulator and is not really affected by its series in-line regulator. Its regulation factor is linear, whereas the suction box cannot be externally regulated that way. You might get reasonably close though, particularly if you have a solid state control for the box too, so you'll have to use what you have and do the best you can. Keep in mind it's not going to be very accurate because of proportional cu ft/min changes in the suction box reacting to the in-line regulation, but it's better than nothing, as long as all comparisons are made at the same setting.

Next, here's the problem with sealants: The tighter the sealant, the stiffer the pouch. Sorry about that, but it's just a physical law of nature. And although a very tight pouch with no leakage can be very sensitive and almost instantly respond to the tiniest air signal from the trackerbar, its repetition is poor. Not only that, but even its initial response is poor at the lowest pump pressures. So poor, in fact, that on a 6-7 ft. piece of tubing, and operating a normal-sized weighted pneumatic, it won't even budge!

Now for coin-operated instruments, orchestrions, and band organs, that kind of sensitivity is never required, so don't worry about it too much. But for reproducing pianos, it most certainly is, and combined with that will be valve gapping.

A stiff pouch doesn't operate a poppet with fast repetition when the distance from the poppet stem to its lifter disk or a primary poppet is well over half of its valve travel. That means the pouch has to travel about twice as far each time and back again to make one repetition. Some might say "*Not so, because the pouch never fully drops during fast repetition. It just weakens*." That's true too, but the ballooning and exhaust takes the rest of that time, an action that's a vector function. ***You don't get something for nothing***.

That means, its vertical lifting force is only a cosine percentage of the total force angle which is limited to the area of the lifter divided by the total pouch area. The valve return trip time is the inverse of that relationship and requires roughly 4 times longer. Bottom line is this: Less bleed makes for a faster trip up (which isn't the limiting factor) and a much slower trip to return. More pouch sealing makes for a resistant pouch and less bleed makes for a more sensitive pouch and so a quicker initial response but far slower repetition, so when you have hugely varying vacuum pressures, that is not necessarily ideal. The time for a poppet to return is the limiting factor in valve repetition speed.

What we are talking about then is no longer, "Who's sealant is the tightest?" It's **whose valves are the best**. Valve operation is not necessarily determined by the world's tightest sealant ("*My sealant is tighter than your sealant*"). It's determined by an ideal balance between pouch lightness and flexibility, and an ideal percentage of bleed for the valve you are rebuilding.

What you want then, ideally, is a sealant that doesn't impede a pouch's flexibility, but will seal porous leather, will also preserve new leather, while being chemically inert. It will never dry out. It will never migrate or get thinner as time goes by, won't evaporate, coat nearby metal parts, make anything impossible to reglue or repair later, or chemically combine with other materials and become a compound.

There really IS such a sealant, and that sealant is thinned silicone grease. Now the thinner is also important. I used to use trichloroethane, but since that's no longer commonly available, I use lacquer thinner. There's an advantage too with lacquer thinner in that it takes up less silicone grease per given quantity of solvent. **That means, you can make a "less saturated solution" with lacquer thinner.** You will know it's saturated when you see the remainder of the grease at the bottom of your container. The thinner will only take up so much, and no more. That means, by applying the mixture with a soft brush (and for secondaries <u>after</u> the lifter disk is glued on), Your mixture will always be exactly the same each time! Testing at low vacuum on long tubing runs will then tell you if you have it about right, and what you measure at that moment will remain exactly that way for the next 100 years—no problem. That's why they use 100% pure silicone grease in outer space—it's inert, no vapor pressure, no creep. It stays exactly where it's put. **<u>Caution; Do not buy anything that claims to merely contain it. It's either 100% pure, or it isn't.</u>**

So I think it is important to first TEST valves by preferably changing the pouch boards on the same block valve upper section. To do that, you simply add a leather gasket to the upper section so you can then clamp it to the pouch boards, done with different sealants and/or methods. Then mount your test valve assembly to a post on a stand, drilled for the test supply and mounting the test pneumatic, sprung or weighted to check out the action at low intensities and long tubing runs. Remember, if you do not find any differences, then you are not testing accurately enough! It's as simple as that. Either there are differences, or there aren't.

Be sure to add the thickness or your added new gasket to the lifter disk on your pouch. Also, if the valve block doesn't have a bleed in it, then add it to the pouch tube, in parallel with its supply to the valve block. Another suggestion is to bundle the tube and

tie it that way in order to make convolutions like it might make inside the piano, since zig-zags also exist in real life and that slows down air movement as well.

All of these tests are necessary for well-informed reproducer rebuilders. They are not as necessary for instruments whose vacuum pressures vary normally, because valve perfection is simply not that critical an issue. No commercial instrument varied between 4" and 40" of vacuum. Keep in mind also that any leather which is over .010" thick is usually marginally suitable for reproducing pianos of any brand, and that the (so-called) Robert Morton "dark pouch leather" is fine for most ordinary players and all organs, but not "fine" for reproducers, even though it is very tight. But, don't take my word for any of this stuff, either. That is NOT the way things are learned for fact. Do your own honest testing and don't "assume" anything or believe anything (even your own opinion), "*just because someone says so, that's why*."

Craig Brougher