

Crosman 13xx HotRod Tech



Here I will attempt to hotrod a Crosman 1322 to achieve maximum power. The results are chronographed at 2 power levels - half and full. These tests are performed the same day, under same temperature with the same gun, valve and box of ammo.

Phase 1

I will start with a stock Crosman 1322, using the old type valve stem. What is the old type valve stem? It is the one that uses a brass head and a rubber seal. The new stems have the entire head made from white teflon.



So which one is better? Lets chrono the 2 stems and compare velocities.

| | Rubber | Teflon |
|----------|-------------------|-------------------|
| 5 pumps | 354.4 | 358.5 |
| | 350.7 | 357.2 |
| | 349.9 | 359.4 |
| | 348.3 | 360.7 |
| | 348.6 | 359.6 |
| | AMV: 349.3 fps | AMV: 359.0 fps |
| 10 pumps | 432.0 | 437.4 |
| | 427.8 | 438.7 |
| | 430.8 | 434.9 |
| | 426.1 | 438.6 |
| | 432.8 | 437.6 |
| | AMV: 429.9 fps | AMV: 437.4 fps |

Gain

5 pumps: 9.7 fps
 10 pumps: 7.5 fps

People like Tim McMurray of Mac1 have long told us that harder seals provide better flow, require less effort to unseat, last longer, etc. Looks like Tim was right! The teflon stem does indeed yield a bit more power, so that's the one I'm keeping in the valve. On to phase 2.

Phase 2

The next thing to nonder is the which check valve to use. Like the

stems, there are 2 types, an older and a newer one. The older one is twice as big as the new one, and as a result takes up twice the space inside the valve. The big check valve came in combination with the brass stem in the older valves. If you order a whole valve from Crosman these days you will get one with a small check valve and a teflon stem.



The smaller check valve would allow for more airspace inside the valve, which should mean more power. Like with the stems, loss or gain in this phase would depend on which check valve you started with. Since I started with a small check valve, putting in the large one would cause a loss in power. The reverse is true if you started with a large one. Let's see which one the chrono likes best :)

| | Large Check | Small Check |
|----------|--|--|
| 5 pumps | 346.1 344.1 344.7 352.4 350.5 AMV: 347.5 fps | 358.5 357.2 359.4 360.7 359.6 AMV: 359.0 fps |
| 10 pumps | 425.3 428.2 424.9 427.4 423.8 AMV: 425.9 fps | 437.4 438.7 434.9 438.6 437.6 AMV: 437.4 fps |

Gain

5 pumps: 11.5 fps

10 pumps: 11.5 fps

That's amazing how exactly the same amount of FPS is gained at both power levels, isn't it? So the obvious choice here is the smaller check valve. Lets move on to the next mod.

Phase 3

Next in line is the valve return spring. A lighter one would allow for the stem to open more and stay open a little longer, dumping a larger amount of pump strokes. This stage is not much different from what is done on the 22xx CO2 valves. Off too the chrono...

| | Stock Spring | Lighter Spring |
|----------|-------------------|-------------------|
| 5 pumps | 358.5 | 363.9 |
| | 357.2 | 372.9 |
| | 359.4 | 370.7 |
| | 360.7 | 371.8 |
| | 359.6 | 372.7 |
| | AMV: 359.0 fps | AMV: 370.4 fps |
| 10 pumps | 437.4 | 463.3 |
| | 438.7 | 461.5 |
| | 434.9 | 462.6 |
| | 438.6 | 462.8 |
| | 437.6 | 460.3 |
| | AMV: 437.4 fps | AMV: 462.1 fps |

Gain

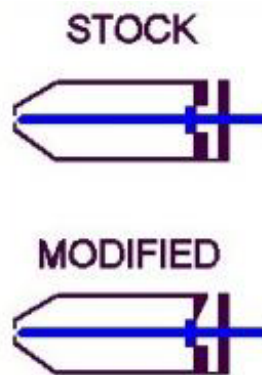
5 pumps: 11.4 fps
10 pumps: 24.7 fps

A very significant gain is noticeable at the higher power level. Hang on to the light spring and toss the stock one. With a lighter

spring the gun is capable of dumping much more than just 10 pumps. But for now, I'll leave 10 pumps as the max power setting.

Phase 4

Just as in CO2 valves, one can expect to gain velocity from changing the transfer port angle. Let address this issue. I took a dremel to the stock t-port and changed the angle from 90 degrees to approximately 115 degrees. The idea here is to remove the sharp turn from the path of the airflow. The horrible diagram below is borrowed from the [2250 section](#), so please pay no attention to the fact that it shows no check valve..



Those of us who drive a car know, making a 90 degree turn going as fast as you can is near impossible. Thanks to the laws of physics, you'd slam into the outside wall and likely kill yourself. We don't have to worry about our airflow killing itself, but we are worried about it slowing down. So if you widen the "track", or the flow path in this case, the air burst should be able to come around the corner faster and less disturbed. Lets see what the chrono has to say.

| | 90 degree port | 115 degree port |
|---------|----------------|-----------------|
| 5 pumps | 363 9 | 373 8 |

| | | |
|-------------|--|--|
| | 372.9 370.7 371.8 372.7 AMV: 370.4 fps | 376.9 376.8 380.2 378.3 AMV: 377.2 fps |
| 10 pumps | 463.3 461.5 462.6 462.8 460.3 AMV: 462.1 fps | 468.2 465.4 467.5 468.3 467.5 AMV: 467.3 fps |

Gain

5 pumps: 6.8 fps

10 pumps: 5.2 fps

Well the gain here is not a whole lot, but as we all know - every little bit counts. If you're trying to squeeze every last FPS out of your gun, don't overlook this mod.

Phase 5

In this phase we'll find out if the shape of the stem head, a.k.a. exhaust valve, has any effect on power. The stock teflon stem has sharp corners, and both stems are larger than they need to be to cover the valve seat. One of the things to do here is to reduce the OD of the stem head. Obviously if you do this on the brass stem, there will not be any metal remaining to hold the rubber seal in place, so a teflon stem is a must for this mod. Shaping is done by chucking the stem into a drill/dremel/whatever and holding it lightly to an abrasive surface like a fine stone or file.





When hotrodding the [22xx CO2 valve](#), I made part of the stem shaft directly behind the head more narrow, to allow better flow. I did not do that here, but if anyone does please [let me know](#) the results.

| | Stock Stem | Shaped Stem |
|----------|-------------------|-------------------|
| 5 pumps | 373.8 | 382.2 |
| | 376.9 | 384.5 |
| | 376.8 | 382.0 |
| | 380.2 | 383.4 |
| | 378.3 | 382.3 |
| | AMV: 377.2 fps | AMV: 382.8 fps |
| 10 pumps | 468.2 | 474.1 |
| | 465.4 | 475.5 |
| | 467.5 | 474.8 |
| | 468.3 | 473.7 |
| | 467.5 | 474.5 |
| | AMV: 467.3 fps | AMV: 474.5 fps |

Gain

5 pumps: 5.6 fps
10 pumps: 7.2 fps

Again, the gain here is not a whole lot, but these little bits do add up. Certainly one would be fine using the stock stem, but there are always those who want all they can get from their gun. This mod is for those people.

This is my last, but most significant phase in modding the 13xx guns. In this phase I will include a tutorial on how to make your own metal piston for a 13xx gun using basic tools. The metal piston will provide better velocities and comes with an oil wiper (if anyone cares).

The whole reason we are able to do this is because Crosman wanted to save money on parts. Instead of making a separate piston for their 2100/2200 rifles, they made an extension that simply plugs into the plastic 13xx piston where the pump cup normally resides. The picture below shows a comparison between the 2100 and 13xx pistons on top, and a disassembled view on the bottom.



While metal is a better material for compression parts, in this case it is totally superseded by the crappy plastic it is coupled with. Why is plastic crappy in this case? As I will mention later, I believe it compresses under high pressures and "buckles", increasing the dreaded dead space between the valve and pump cup. What we benefit from here is the metal extension Crosman implemented for the 2100/2200 rifles.

The complete 21/2200 piston is part #2200E018 and can be ordered from Crosman by calling their service dept. at 800-724-7486

As shown in the picture, it comes with a 13xx plastic piston, a metal extension and a pump cup. I am not sure if you can get just the metal extension, my parts diagram is a bit old and doesn't show any independent part #'s for the assembly, so I assume it only comes as a whole.

Machinists should jump all over this as these 13xx metal pistons are easy to make from the mentioned parts. I am sure people would buy them up, as they have other upgrade parts for their crossmans. I however will only provide free directions to make one yourself.

| | Stock Plastic Piston | Longer Metal Piston |
|----------|--|--|
| 5 pumps | 382.2 384.5 382.0 383.4 382.3 AMV: 382.8 fps | 396.6 396.4 397.6 398.8 397.7 AMV: 397.4 fps |
| 10 pumps | 474.1 475.5 474.8 473.7 474.5 AMV: 474.5 fps | 508.2 512.6 508.4 508.3 508.6 AMV: 509.2 fps |

Gain

5 pumps: 14.6 fps
10 pumps: 34.7 fps

How to make a metal piston

Here is a brief tutorial on how to make your own metal piston for your 13xx gun out of a 2100/2200 piston extension. This process is pretty easy for the determined. but some may find it a bit too

involved. You'll need at least some basic knowledge of making accurate measurements and a tool to make them along with a hacksaw, drill and a vice.

Lets begin. Measure the length of the plastic piston and cut the metal one to that length. A little bit longer is OK too.



Using a marker, or as I did, white-out; mark the slot thru which the lever will attach.



Right on the lower line of your marked slot, drill a hole all the way thru. Make sure you are centered while drilling. A drill press is nice here, but this can be done in a vice using a hand drill.



Put the piston into a vice and cut along your marked line down to the drilled hole. This can be done with a hacksaw, but as always, a man will use whatever tool he prefers or has available :)



After you cut along both sides of the drilled hole, the finished product should look like this:



The next thing to do is to mark and drill the hole thru which the retaining pin will attach the pumping lever. It is important that you measure carefully here. Don't drill it too close to the felt wiper end or your piston will be too short and you'll lose power. If you drill too far away from the wiper end, the pumping lever won't shut because the piston will be too long.. Take an extra measurement to be sure before you drill! It's up to you how much you wanna preload the piston if at all here. I made mine 1mm longer than

stock and didn't use a shim under the cup. What you do is up to you.



If you made your slot wider than the lever, that's good because you can now install teflon riders, or shims. All you need is a few strips of teflon about 1mm thick which is available from [McMaster-Carr](https://www.mcmaster.com/). There are 2 ways to go here - shims or a sleeve. A sleeve will take a bit more time to make right, but offers an advantage I'll explain in a bit.



If you decided to make shims, drill a pair of holes in the strip, then cut around them to until you have 2 washers:



The shims are placed between the lever and piston to ensure

smooth operation and minimal friction and are held in place by the retaining pin.



The metal piston with shims installed should look like this:



Shims are OK, but the only problem is that the OD of the metal piston is slightly less than that of the plastic one. As a result, there will be a bit of "slop" during the pumping process which will cause a metallic sound. This drove me nuts so I came up with a sleeve that takes care of the problem and still does what the shims did. You need to cut a strip of teflon to the same width as the depth of the slot in the piston. The teflon must not be thicker than 1mm or the piston won't fit into the pump tube. Fold the strip around the piston into the shape shown at the bottom of the

picture. The holes must be drilled with accurate spacing here, or the sleeve won't fit right. Wrap it around the piston a few times before you cut the holes. A good way to get the holes spaced right is to use a paper template, then trace it on the teflon strip.



Once you got the holes spaced right, slide the lever into the piston, between the sleeve walls and install the retaining pin.



That's it! The metal piston is now complete and ready to be installed into the gun. If you went with the sleeve, the first time installing may be a bit tough, but the sleeve will wear-in and movement will be easier with use.

Why not just shim the plastic piston? I thought the same thing at first. Below is some stunning data about shimming a plastic piston. I really don't know why an unshimmed piston made of plastic would yield better velocities than a shimmed one. If you know, please [inform me](#) and I will post it here. As of now, the only explanation I can offer is that when the plastic piston attempts to make higher pressures after being shimmed, the plastic compresses or "gives in" to the higher pressure - actually creating more dead

space between the pump cup and valve. I have no proof to substantiate this claim, it is just a theory and I welcome corrections. I was so stunned after seeing the data below that I repeated the test 4 times in disbelief. Every time the end result was the same - shimmed plastic piston lost power.

| | Unshimmed Plastic Piston | Shimmed Plastic Piston |
|-------------|-----------------------------|---------------------------|
| 5 pumps | 377.0 | 360.7 |
| | 376.1 | 358.9 |
| | 379.1 | 360.6 |
| | 378.5 | 360.7 |
| | 378.9 | 361.0 |
| | AMV: 377.9 fps | AMV: 360.3 fps |
| 10 pumps | 464.1 | 445.7 |
| | 466.7 | 446.2 |
| | 469.5 | 448.0 |
| | 469.0 | 442.0 |
| | 469.3 | 445.6 |
| | AMV: 467.7 fps | AMV: 445.5 fps |

Loss

5 pumps: 17.6 fps
10 pumps: 22.2 fps

Summary

As you can see in the chart below, from "bone stock" to "phase-6 modified" we gained 48 fps at 5 pumps and 79 fps at 10 pumps.

I apologize for using such a crappy pellet in the tests. I did not have enough of any other one pellet to do this at the time. I have seen .22 cal Daisv pellets varv from 13.2 to 13.8 gr from tin to tin.

Now I just estimate them to be around 13.5gr. This means the pistol went from 5.5 fpe to 7.7 fpe at full power.

Well, actually because of the light valve spring now installed in the valve, my gun will consistently dump up to 30 pumps, so that would be the full power level now; but I don't recommend doing this repeatedly because so much pumping will heat up the internals.

If you are wondering what the gun will do at 30 pumps I got mine to shoot 604 fps with daisys - that's 11fpe! More amazing, with 29gr Dae Sung's mine did 457fps at 13.4fpe! That's a lot of punch for a 12" pumper pistol for \$50. Again, it is not a good idea to keep shooting the gun at 30 pumps. If you must shoot it at that power, shoot at 25 pumps and don't do it more than 2-3 times in a row. The seals cannot handle all the heat created by all that pumping, and the gun needs time to cool off. This pistol has plenty of power even at 10 pumps, when you go over that you're doing so at your own risk.

Please keep in mind that your results may be slightly above or below mine, all depending on your work and materials used. For example, if you used a moderate valve spring instead of an extremely light one like I did, you will probably need to upgrade to a heavier hammer spring to dump all the air. Also, tolerances vary from gun to gun. Your piston may need to be longer (or unlikely shorter) than mine to get the same results. It's a good idea to order more than one 2100 pistons from Crosman and play with different lengths. I hope you found this article useful, if you have any questions, please [email me](#).

| Phase | Gain |
|-----------|---|
| Stock - 1 | 5 Pumps: 9.7 fps 10 Pumps: 7.5 fps |
| 1 - 2 | 5 Pumps: 11.5 fps 10 Pumps: 11.5 fps |
| 2 - 3 | 5 Pumps: 11.4 fps 10 Pumps: 24.7 fps |
| 3 - 4 | 5 Pumps: 6.8 fps 10 Pumps: 5.2 fps |
| 4 - 5 | 5 Pumps: 5.6 fps |

| | |
|-----------|---|
| | 10 Pumps: 7.2 fps |
| 5 - 6 | 5 Pumps: 14.6 fps 10 Pumps: 34.7 fps |
| Stock - 6 | 5 Pumps: 48.1 fps 10 Pumps: 79.3 fps |

[The Air Pit](#)