

Pressurizing Antenna Launchers

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A lot has changed since I wrote about this subject years ago, it is time for a new updated article for 2021.

Key to using Pneumatic Antenna Launchers is developing Launch Pressure. The launch drains all the pressure in the tank, so each launch requires a refill. It is about like filling a small bicycle tire, and tools suitable for filling bike tires are usually well suited to launchers. Launch pressure varies from around 30 to about 90 psi, depending on the launcher and the height you need to reach.

Manual pumps intended for bicycle or car tires in this pressure range work well. Foot pumps used to be popular and are easy to operate, and hand pumps have been around for a very long time. It generally takes a minute or two of pumping to reach launch pressure. If you want to keep it simple, this is the way to go. The very small pumps made for carrying on a bicycle are not easy to use, they may be a suitable backup but not the main pressure source if you have very many launches to do.

These days some electric pumps using tool batteries have become smaller, they take about the same time but reduce the sweat. My favorite electric in 2021 is the Ryobi P737 18 volt ONE+ battery operated pump. There is a newer digital P737D model of this pump as well. Both of these have a large gauge and do a lot of pumping even with a small battery. I prefer the smaller batteries for their reduced weight.



You can pick these up at Home Depot, they are about \$30-40 without battery. If you have some of the Ryobi power tools that use the ONE+ 18 volt battery system you won't have to invest in batteries and chargers. If you don't have these tools and batteries already you might look at your favorite brand of battery powered tool and see if they have a similar portable compressor. Many brands have compressors but few are as compact as the Ryobi. If you need a Ryobi battery the best deal is often to buy a combo set with a drill, battery and charger, often on a discount.

I made a mount to attach the Ryobi to a launcher but it is a bit bulky with both clamped together:



CO2 can also be used. The CSV17 launcher chamber is optimized to get a good launch from a 12 gram CO2 cartridge, a common and inexpensive size. Adapters to fill bike tires from CO2 cylinders are made for backup use, here's one example, I found similar units at Amazon, REI and bike stores. The cartridges are available in bulk for around 25 cents to over a buck each, so not the cheapest but small, quick and convenient - though changing a cartridge for each fill reduces the convenience factor somewhat. I often carry these as backups. Here's one with a 12 gram cylinder:



Next we will talk about convenient and faster but more expensive ways to fill Antenna Launchers. These are more than most users will need, but if you happen to have other applications (like Paintball or High Pressure Airguns or launching many antenna lines for Field Day or friends) you may have interest, especially if you happen to have some of the equipment on hand already from another hobby.

A larger refillable CO2 tank used for paintball, airsoft and airguns (9 to 24 ounces can refill a launcher many times, and is very quick to do the job (a few seconds can fill the launcher). However the CO2 pressure or flow from the tank must be regulated to avoid excessive pressure in the launcher. CO2 pressure is a function of fill percentage and temperature, it can range from 400 to 800 or more psi. Here are two solutions for using these tanks to fill your pneumatic launcher. The first is a pressure regulator and the second is a flow limiting valve:



This pressure regulator (above) is set up for launcher use by adding a tube, adapter and schrader fill chuck to the outlet of a pressure regulator. A 3D printed clamp is added to make the setup solid. It can be used one-handed (while holding the launcher in the other hand). The output pressure is adjustable and this can be set to a safe level for the launcher (100 psi), providing an extra level of protection against overfilling the launcher. The gauge on the launcher is used to monitor the fill. We can make these up as a special order, see the online catalog at akbeng.com/catalog.



The PowerTank Power Shot tire filling adapter (above) has no pressure regulation. It uses a trigger to operate the valve in the tank to control the flow. It delivers the full inlet pressure to the launcher, so it is prudent to have a safety valve on the launcher and closely monitor the

pressure gauge when filling to avoid excessive pressure. It is available from PowerTank.com with a CO2 tank or separately. PowerTank also has larger CO2 tanks and regulators for directly filling tires and launchers, with 5 to 20 pounds of CO2 capacity. We have used these and they work well but are heavy and bulky to carry, and contain a lot more CO2 than is needed for most launching situations. If you have some tires that you want to air down and refill quickly in the field, or want to run an air tool from a CO2 bottle their high flow CO2 systems may be of interest to you.

Note that pressure regulators have O rings and seals that need to be rebuilt periodically as the CO2 is hard on them (CO2 is a solvent and attacks the rubber in the seals and O rings, and the wide temperature variations are hard on them as well as not good for the PVC). It is prudent to carry a pressure regulator rebuild kit and tools. The Power Shot Tire filling adapter doesn't require rebuilding as the tank's internal valve is used, the trigger just pushes the valve pin and directs the flow. It is a well made and trouble free unit, but it does require two hands to use (so the launcher must be set down or a helper is needed).

There is one O ring on the top of the CO2 tanks that requires periodic replacement. Each time the tank is removed this O ring should be checked visually and replaced if damaged.

Paintball CO2 tanks come in a number of sizes, and can be refilled at a local paintball/airsoft store or field for a few dollars. They can be filled at home from a larger siphon tube equipped (or inverted) CO2 bulk tank with a fill station and scale. Bulk CO2 fills of 20 pound tanks costs around a dollar a pound, most outlets do a convenient tank swap and they take care of the periodic recertification, you buy a tank initially to get into the rotation. The paintball CO2 tanks require pressure safety recertification or replacement every 5 years, but they are fairly inexpensive so generally they are just replaced rather than recertified. The smaller tanks (up to 12 ounces of CO2 capacity) usually fit into the barrel of the launcher for storage which is convenient. The number of shots you get from a CO2 tank depends on the ambient temperature, launcher tank volume and on how much pressure you need to use for the launch, refer to the table below for some estimates. CO2 in the liquid state is around 700 psi at room temperature, and the tanks can only be about half filled to avoid dangerous pressure spikes at elevated ambient temperatures. At lower temperatures the pressure drops considerably and CO2 consumption rises dramatically. Here's a typical 12 oz CO2 paintball tank. These typically come empty and need to be filled before use, though if you buy it from a paintball store or field they often come prefilled:



Another prefilled disposable paintball / airgun CO2 tank that is readily available at stores like WalMart and not refillable are the 88 or 90 gram cylinders. These are smaller than the refillable types but much larger than the 12 or 16 gram disposable CO2 cylinders. One of these should be adequate for more than a half dozen launches. They require an inexpensive adapter to fit the Paintball Tank standard fittings such as the above CO2 regulator or Tire Filling Adapter.



The following table shows some different fill sources and the approximate number of antenna launcher fills for a CSV17 to 50 psi or a CSV19 to 40 psi which are typical medium power launch values. Liters is the volume of gas stored in the bottle at standard temperature and pressure. Aluminum tanks are “al”, carbon fiber “cf”.

Tank Description	Type	Liters	CSV17 50	CSV19 40	Store in Barrel	Notes
12g co2 cylinder	co2	6	1	-	yes	prefilled disposable cylinders
16g co2 cylinder	co2	9	2	1	yes	
90g co2 cylinder	co2	45	12	8	yes	
9 oz co2 al	co2	120	40	25	yes	refillable from co2 bulk tank or at paintball field or store
12 oz co2 al	co2	165	55	35	yes	
20 oz co2 al	co2	250	80	50	no	
13 ci / 3000 al	hpa	40	12	8	yes	refillable with special compressor
26 ci / 3000 al	hpa	80	25	15	yes	
48 ci / 3000 al	hpa	160	50	30	no	
68 ci / 4500 cf	hpa	340	100	60	no	also good for tires
100 ci / 4500 cf	hpa	500	150	90	no	for refilling 13 and 26 ci tanks
6 gal 120 psi	air	150	25	18	no	fill with shop compressor

CO2 has fallen from favor in the paintball and airsoft business, they are moving to High Pressure Air. This is air (or in some cases Nitrogen gas) compressed to 3000 or 4500 psi. Tanks made for this higher pressure are heavily constructed (from aluminum or carbon fiber wrapped aluminum) and more costly, though some look a lot like the aluminum CO2 tanks on the outside. Generally the antenna launcher filling capacity is about half as many shots as a CO2 tank of similar outside dimensions. HPA tanks have a pressure regulator on the neck of the tank that brings the high pressure down to about 800 psi, so it is compatible with the CO2 gear. High Pressure Air tanks can be refilled at paintball stores and fields or at home with a High Pressure Air compressor that is specially designed to reach 3000 or 4500 psi. This is NOT a common shop compressor, which generally reaches only 120-200 psi. HPA compressors are related to SCUBA compressors but don't have all the air scrubbing required for breathable air. There are some cheap 2 stage units that usually don't last very long, and good ones are three or four stages and quite expensive. The HPA tanks require replacement or pressure safety recertification every 5 years, similar to the CO2 tanks. The most interesting small tanks for antenna launching are the 13 and 26 cubic inch aluminum types. Here's a 13 cubic inch 3000 psi tank. The 26 cubic inch tanks are a bit taller and larger in diameter.



Note that the same CO2 regulator also works for High Pressure Air, but the O rings and seals last much longer when used with air. The Power Shot Tire Filling Adapter also works well with air. The HPA tanks also have the same O ring on the tank that requires periodic replacement but again this O ring lasts longer with compressed air rather than CO2 which tends to soften and swell the rubber. Carry spare tank O rings just in case.

HPA tanks up to about 26 cubic inches will fit into the launcher barrel (2.5 inches inside diameter) for storage, which is convenient. The smaller 13 cubic inch tanks are very convenient when only a few launches are required and take even less storage space. The 3000 psi types

are generally aluminum tanks with a flat bottom, and the 4500 psi types are generally an aluminum inner tank covered with a carbon fiber and fiberglass wrap. These have rounded ends and cost quite a bit more but are lighter in weight and hold a lot more air (and require a higher pressure compressor to fill).

One convenience of high pressure air is the tanks have a pressure gauge and you can readily tell how much air remains. With the CO2 tanks there is no gauge, and the tank must be accurately weighed and compared to the empty weight to calculate the CO2 remaining. It is easy to top off a High Pressure Air tank, but it is tricky to top off a CO2 tank, and easy to overfill a CO2 tank in which case excess pressure may blow out the safety diaphragm when it warms up. The HPA tanks heat up when you fill them, then their pressure drops slightly as they cool off. Another topping up fill cycle can be used to reach full pressure if desired. When filling a CO2 tank they must be vented and very cold to get flow and the pressure rises as it warms up after the fill which can be dangerous if the tank has been overfilled.

The 3000 psi HPA tanks can easily be filled from a 4500 psi tank in the field with the proper adapters so one convenient setup is to take a couple of the smaller 3000 psi tanks and a larger 4500 psi tank to use to refill the smaller ones. A 100 cubic inch 4500 psi tank will fill about 3 of the 13 cubic inch tanks to 3000 psi before itself dropping below 3000 psi, further fills will be to whatever pressure remains in the larger tank. This tank does not have fittings to fill the launcher directly, but instead fills the smaller tanks. They can be found discounted when their recertification date is much less than 4 years out. Carbon fiber HPA tanks must be recertified every 5 years up to 15 years after that they must be retired. Aluminum HPA tanks must be recertified every 5 years but don't have a limit. Here's a 100 cubic inch 4500 psi carbon fiber bottle for refilling the smaller bottles, it will fit into an 18 inch tool case:



Another technique is to use a portable low pressure air tank. These are large (typically 5 to 11 gallons), can be filled with a shop compressor and will give you 20 or so launches. They are quite bulky but get the job done. They don't typically have recertification requirements. They are available in steel or aluminum from Harbor Freight Tools or automotive tool sources. The steel ones rust and are heavy so lighter rust-free aluminum may be preferred, but either is a bit large for lugging in the field. Much less of the air is available for filling the antenna launcher due to the large volume and low initial pressure in the tank.



The cost of CO2 or HPA equipment is significant, especially when you factor in tank recertification / replacement. This is not generally worthwhile for antenna launching alone, but if a person has other uses for the CO2 and/or high pressure air it may be convenient to use for antenna launching as well.

Note that if you are flying commercial there are a number of safety related rules to deal with - for one the CO2 and HPA tanks must be empty (and there may be other requirements like actually removing the valve). So they will have to be filled after landing. The lithium batteries on the electric pump may also be a problem, so you might want to get nicad or nickel metal hydride tool batteries to avoid battery issues, if the airline will accept those more readily. Or use a manual pump, or purchase prefilled disposable CO2 cylinders at the destination if they are available. Check with the airlines you will be using for details

Launcher Won't Fill Problems

I have run into a few electric pumps that work fine on car tires but fail to work on launchers. One customer recently reported that a small electric pump worked on launchers one year, and not the next, even though it still works on tires. The small rigid chamber of the launcher doesn't keep the back pressure as even and pumps with low quality check valves and small pumping cylinders may not work effectively into a launcher. Some launchers, especially those with larger valves (such as piston valves), require a strong airflow to seat the valve. For these a larger pump or tank type source is required. CO2, HPA, low pressure air tanks or air from the shop compressor work well in these cases. Make sure you test your fill system with your launcher to see that it is compatible before you find out the hard way it doesn't work far from home. :)

Wear your safety gear - especially eye protection whenever working with compressed gas and antenna launchers.

Safe Launching,

73, Alan, w6akb (previously wb6zqz)

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