

Homemade Primer Course

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Warning/Disclaimer

This course discusses the creation and work with chemical compounds and mixtures that present a real risk of serious injury and/or death if mishandled. In addition, some of the chemicals discussed are toxic and present a danger to a person's health if inhaled or ingested. Primer compounds are considered to be "Primary" explosives. This designation is a result of the sensitivity of these materials to percussion, heat, and sparks (both electrical and mechanical) and their intense power during detonation. Therefore, anyone who uses this information to make primer compounds or primers does so at their own risk. The

creators and instructors of this course will not be held legally liable for any accidents or injuries resulting from this information.

To avoid serious injury or death, always work with primer compounds in small quantities of less than ~2 grams (~30 grains) at a time. Always wear eye protection and work in a clutter free, well-ventilated area. It is recommended that wood, plastic, or other non-sparking tools be used to avoid accidental ignition of primer compounds and primers. Work on a non-porous surface and carefully clean up all residue and dust from the work area when finished. It is important to wash your hands thoroughly with soap and water after working with primer compounds to avoid accidental poisoning.

Is it Legal

According to current BATFE rules, making ammunition primers for your own personal use is legal (as is making your own fireworks.) Selling them or even giving them away is not legal without acquiring the appropriate Federal Licence(s) for manufacturing and selling explosives. Despite the absence of Federal restrictions on personal primer manufacture, there may be state regulations that affect how you store certain chemical compounds and in what quantities they may be stored. Consult competent legal advice if you are unsure of your particular situation. Be aware that making primers in your home, garage, or external workshop is likely to carry more restrictions than making them in a commercially zoned building.

So, making primers on a small scale for your own personal use is unlikely to get you into trouble. None-the-less, expect your name to appear on some government list if you purchase several of the chemicals needed to make various primer mixtures. Finally, some very useful chemicals for making primers are legally restricted by the government (e.g. Red Phosphorus) and cannot be legally purchased or possessed by individuals who do not have the appropriate licenses or work for a company that has a legitimate need for those chemicals.

How Do Primers Work

The Discovery of percussion sensitive chemicals

In the 1700's and early 1800's, a number of chemists made various compounds that were found to be sensitive to shock, heat, friction, and sparks. While many of these compounds were extremely sensitive dangerous and unpredictable, others were more tame and although risky could be manipulated and used for various purposes such as military explosives. One such material was mercury fulminate which was easily synthesized from metallic mercury, alcohol and acid.

In general, all percussion sensitive chemicals are ignited in the same way under a sharp blow. As the material is crushed, sharp edges on some of the primer ingredients rub against one another creating friction and very localized high temperatures. When these temperatures become high enough, the reaction of the primer mixture is initiated and rapidly spreads throughout the mass generating heat, flames and incandescent particles. There is a threshold of impact energy that must be crossed to ignite a given primer mixture. This threshold energy is routinely measured by commercial primer manufacturers

on every lot of primers they make to be sure they are neither too sensitive (e.g. round goes off when accidentally dropped on a hard surface) nor too insensitive to impact (e.g. misfires.)

Percussion Caps

During this same time, flintlocks were the state-of-the-art in firearms but suffered from unreliable ignition, especially in rainy or damp conditions (recall the admonition to “keep your powder dry”.) The search for a better ignition system eventually brought the shock sensitive compounds together with firearms. Percussion caps were first made and patented in the early 1800’s and were widely used until the end of the Civil War. These caps were typically composed of a copper cup partially filled with a mixture of mercury fulminate and several other chemical compounds. The caps were placed over a nipple containing a hole that led to the powder charge inside the barrel. When struck by the gun’s hammer, the primer compound exploded sending hot gases and sparks through the nipple to the powder charge causing it to ignite. This invention greatly improved the ignition reliability of muzzle loading guns.



Rimfire Metallic Cartridges

Several decades after the development of percussion caps, a self-contained metallic cartridge was designed that placed the primer compound into a deformable hollow rim. The 22 short was the first metallic cartridge introduced in the US (1857) and continues to be commercially available to this day. Other larger caliber (up to 56 caliber) rimfire cartridges were designed and used in the Civil War and were commercially available until the early 1900’s. All of these larger caliber rimfire cartridges were eventually replaced by the superior centerfire design due to the pressure limitation of the rimfire casing. The requirement to have a rim that was thin and soft enough to crush with the firing pin limited the internal pressure that these casings could safely contain without failing.



Centerfire cartridges

Shortly after the Civil War, new cartridge designs were developed to make the production of ammunition more efficient. Eventually, the current centerfire cartridge design was developed that used a separate primer located in the center of the cartridge head. A major advantage of this design was that the cartridges could be easily reloaded by replacing the fired primer with a new one, refilling the case with gunpowder, and pressing in a new bullet. Reloading tools quickly appeared allowing cowboys to reload their ammunition while sitting around the campfire in the evenings.



Mercuric primers work great but make brass brittle

The same types of priming compounds originally used in percussion caps were still being used in the new centerfire primers. It was discovered that the cartridge brass became brittle and tended to crack when reloaded. This embrittlement was found to be caused by residues from the mercury fulminate based primers. Metallic mercury formed during the combustion of mercury fulminate selectively attacked and amalgamated the zinc in the brass alloy causing it to become brittle. Pure copper casings were briefly used to avoid this problem, however, copper was found

to be too soft to hold up well to the high pressures generated during firing. Therefore, to preserve the brass for reloading a new primer compound was needed that did not use mercury fulminate. Despite the knowledge that mercury fulminate based primers ruined brass casings for reloading, non-corrosive mercuric primer formulations continued to be used in commercial ammunition until the early 1940's.

Non-Mercuric primers were developed to save brass

In the late 1800s mixtures of potassium chlorate ($KClO_3$) with various "fuels" were found to be suitable for use in primers. These mixtures were reliable and had a long storage life even under unfavorable conditions commonly encountered in military campaigns. The main negative aspect of these primers was their "corrosive" effects on steel barrels and receivers. This was especially noticed with the conversion from black powder to smokeless powder which occurred around the same time. When black powder burns it produces a large quantity of soot and other residues that coat the inside of the gun barrel. This powder residue was found to create a protective barrier to the corrosive effects of potassium chlorate primer residues. When ammunition cartridges began using smokeless powders, they burned so cleanly that no significant residues were formed inside the barrel. Therefore, the corrosive primer residues came into direct contact with the steel and rapidly caused pitting, rusting and corrosion. Since significant corrosion could occur overnight it became necessary that guns be cleaned within hours of being shot to avoid damage.

Non-Corrosive primers were developed to protect barrels

In the 1930's new non-corrosive primer formulations were developed in Europe that eliminated the requirement to clean guns quickly after shooting them. The combustion residues are non-corrosive to steel and brass. Most of these new formulations are based on lead styphnate, an explosive lead salt. More recently, some of the newer "green" primers have replaced lead styphnate with safer chemicals that do not contain toxic heavy metals. Virtually all commercially available primers today use either lead styphnate or lead azide as the primary explosive.



The Ideal Primer

Commercial primers are amazingly reliable devices with a failure rate of less than 1 in 3 million. It is interesting that the most important step in primer manufacture, filling the cups with primer compound, continues to be done by hand. Despite this phenomenal performance, no “ideal” primer exists today. The ideal primer should perfectly meet all of the following requirements.

Single compound

It would be great if a single pure chemical compound could be used in the primer. Unfortunately, no material has yet been found that can perform all the required functions. Therefore, all modern primer compounds continue to be composed of physical mixtures of 3 or more compounds.

Sensitive to percussion

This property is a fine line. The primer must be sensitive enough to be reliably set off by the firing pin strike, but not so sensitive to be set off by normal manufacturing and handling processes. Ever notice that accidentally dropped rounds almost never fire? This is why.

Generates hot flame/sparks

Obviously the fired primer has to generate enough energy to ignite the propellant. This is relatively easy when fast pistol powders are being ignited. Magnum pistol and most rifle powders are much slower to burn and harder to ignite. Also, some powders are susceptible to position variability when used at low fill rates unless a suitably energetic primer is used.

Insensitive to heat/humidity during storage

Ammunition is often assembled and stockpiled for years before use. The primer must not quickly degrade when the ammunition is stored in less than ideal conditions. Commercial primers are calculated to last at least 150 years when stored under normal temperature/humidity conditions. I am personally aware of ammunition made in the 1870s that has been shot in 2014 without any problems (i.e. no misfires or squibs.) Today’s primer compounds are even more stable to storage than the typical mercury fulminate based primers made in the 1870s. The main exception for primer stability are some of the new “green” primers. Some of these are known to have problems with a short storage life.

Safe to manufacture/handle

In this case, safe is only a relative term as any primer formulation that is sensitive enough to use in ammunition will inherently be risky to make and handle. It is hard to appreciate the tremendous amount of energy released by the tiny amounts of primer compound used in an ammunition primer. A teaspoon of primer compound is easily enough material to cause serious injuries, damage or a fatality should it unexpectedly explode. Commercial primer manufacturers know that even with the best possible precautions and safety procedures, an accident will occasionally occur during primer production. These companies manage this risk by using small batch sizes of primer compound (they typically work with 1-5 lb batches) working in reinforced blast proof buildings and only allowing a few employees to work in the building at a time. Despite these precautions fatalities still happen but are thankfully rare. Primers can

tolerate a surprising amount of abuse when slowly deformed (i.e. staying below the threshold energy for ignition.) However, an accidental stray spark of static electricity could easily cause an entire batch of primer compound or prepared primers to go off with disastrous results. There is a good reason why special HazMat fees are charged to ship primers. In summary, no compound that is shock sensitive enough to be successfully used in primers will be totally free of explosion risks during its manufacture or handling.

Non-toxic

Because of the use of lead styphnate and other heavy metal salts, modern commercial primers create various hazardous residues during combustion. This is normally not a problem when good ventilation is present and exposure is infrequent. However, workers at indoor shooting ranges can sometimes be exposed to enough lead in the air to cause health problems. This was the main reason for the creation of "green" (i.e. no heavy metals) primers. Interestingly, the non-mercuric but corrosive primer compounds used in the late 1800s are much safer for your health since no heavy metal salts were used.

Basic Types of Primers

The primer compound is a mixture of materials performing one or more of the following functions: 1) initiator, 2) oxidizer, 3) fuel, 4) sensitizer, 5) frictionator, and 6) binders. There are 4 general classes of primer compounds, each with their own advantages and disadvantages.

Mercuric/Corrosive

This class represents the original compounds developed for percussion caps. These primers have a good balance of energy and sensitivity and are simple to make. The combustion residues are corrosive and require prompt cleaning of the gun after using it with these primers. As noted before, the use of mercury fulminate made brass cases brittle so they could not be safely reloaded.

Mercuric/Non-Corrosive

Once the corrosive nature of the older mercury fulminate primer compounds was recognized, other formulations were developed that while still using mercury fulminate, were no longer corrosive. These primer compounds still ruined the brass cases for reloading, but they no longer corroded steel barrels. Primers using this type of compound continued to be available until the start of WW2.

Non-Mercuric/Corrosive

In the late 1800s, the US military decided they wanted to reload their fired casings to save money on ammunition. A new primer compound that was non-mercuric was developed that did not harm the brass, but was also found to be corrosive. These primer formulations are mostly based on potassium chlorate mixtures. It was not until the early 1920s that the corrosive residue attacking the steel was identified as potassium chloride. The damage to the gun barrel can be easily prevented by washing out the corrosive salts using hot water. This cleaning procedure was routinely used by all soldiers until about 1950 when all military ammunition was converted to non-corrosive primers.

Non-Mercuric/Non-Corrosive

All modern commercial primers are of this class. Most of these primers are based on lead styphnate, although some use lead azide. Except for the new “green” primers, all of these primer mixtures generate toxic heavy metal salts during combustion.

Reliable Homemade Primers

Of all the techniques and methods available to make homemade primers, only three are considered feasible. Regrettably, all of these methods produce primers of the non-mercuric/corrosive type and require the tried and true hot water cleanup procedures to avoid damaging your barrel.

Preparation of primer cups

It is entirely possible to make your own primer cups from sheet brass if you are a machinist or are able to have the special dies custom fabricated. The needed technical drawing for making these dies can be found in the “Making Ammunition” reference book noted in the appendix.

It is more convenient to reuse previously fired primers (you have been saving them, right?). However, they must be properly cleaned and prepared for reuse. The steps below show my technique for preparing the primers.

1. Fill a rock tumbler drum about 1/3 full of used primers. Fill with water to about 2/3 full and add a squirt of dish detergent. Seal up the drum and tumble for about 30-60 minutes. Pour off the dirty water, rinse the primers and repeat the cleaning operation 2 more times. This will remove virtually all of the toxic lead salts from the primers and make them clean and shiny.
2. Pour out the clean damp primers onto paper towels, spread them out into a single layer and allow them to drain and dry overnight.
3. Next remove the anvils from the primers by holding the primer with a pair of needle nose pliers and using a sharp pointed awl or similar tool get under a leg of the anvil and pop it out. With a little practice, you can do this quickly and easily without losing the tiny anvils. Remove any paper residue (i.e. the foil) you may find that sometimes remains in the primer cup. Discard any primers that are excessively distorted or flattened. It has been my experience that large rifle primers can rarely be reused due to excessive flattening.
4. Using an appropriate sized flat punch or flattened nail, set the primer on an anvil or other metal block and punch out the firing pin dimple. It is rare for the firing pin dimple to be completely removed during this operation since the metal can flow under the firing pin and be slightly thinner than the surrounding areas. Discard any primers that have an especially heavy primer strike or are pierced.
5. Store the prepared primer cups until ready for reloading.

I recommend keeping SR and LR primers separate from SP and LP primers. This will avoid problems with misfires in pistol cartridges due to the thicker primer cups used in rifle primers. Sometimes they

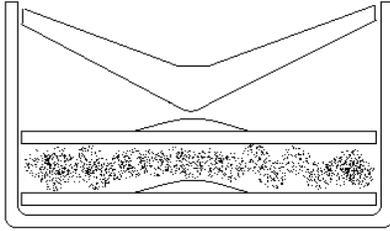
work and sometimes they don't or require multiple strikes to get them to fire. The same issue would exist if you were to use new rifle primers in pistol cartridges. The firing pins in pistols are not able to strike the primers as hard as a rifle does.

Primers made from toy caps

This method is the easiest, safest and least likely to get you on a federal watch list. On the other hand, the resulting primers are not very energetic and may fail to reliably ignite some powders. The best toy caps to use are made in Germany and can be found under various brand names at Walmart or at Dollar General. The caps made in China are inferior for use in cap primers. Don't waste your money buying them. Here are the steps for making cap primers:

Materials needed: a) leather punch or handheld 1/8" paper hole punch, b) rolls of good quality caps, c) bamboo skewer, d) fast pistol powder

1. Using a leather punch, cut out a number of cap blisters from the roll of caps to the appropriate size to fit inside of the primer cups you are reloading. For SP primers, I have found that hand held paper hole punches that make 1/8" holes will work well. As much as possible, try to center the cap blister in the punched out circle. Expect to accidentally set off a few caps while doing this operation. If you do pop off a cap or two, carefully wash the punch when you have finished with hot water or the punch will quickly start to rust from the corrosive cap residue (i.e. just like your gun barrel.)
2. Place one cap circle inside of a prepared primer cup with the blister facing up and carefully pack it down with the end of a bamboo skewer.
3. To give the primer a little more energy, sprinkle a thin single layer of fine gunpowder over the cap. Bullseye is an excellent choice, but any fine grained pistol powder will work. I have a cup of scrap gunpowder I use for this purpose that was recovered from live rounds I occasionally find in the brass box at the range.
4. Place the second cap circle, blister side up, over the gunpowder and carefully pack it down with the bamboo skewer.
5. Finally, place a saved anvil over the cup and carefully/slowly push it into place using the side of your needle nose pliers. Even being very careful, I typically pop off about 1 out of 20 primers during this operation. If that happens, disassemble the primer, clean the cup and reload with new caps and gunpowder. Once assembled, the primer is ready for immediate use. To avoid accidentally popping the caps, it is possible to desensitize them by lightly moistening them with 90% isopropyl alcohol before pressing in the anvil. After the alcohol and water evaporates (at least several hours or leave overnight to be sure they are dry) the caps become sensitive again and will work like normal.



6. Save your completed primers in an empty primer box, or use them as normal in making ammunition. Any difficulties in getting the primers to seat properly can usually be traced to a distorted primer cup. The more discriminating you are when sorting out questionable primer cups, the less likely you are to have any problems seating the reloaded primers. It is rare to have a cap primer pop during normal seating in a casing but it does occasionally happen. When made correctly these primers have excellent reliability. With good consistent assembly techniques, less than 1 out of 1000 cap primers will typically be expected fail. In most cases I have analyzed, the cap primer was found to have fired, but was not energetic enough to set off the gunpowder. These primers have successfully set off powders as slow as IMR 4895 used in 223 Remington cartridges.
7. The cost of making cap primers is quite low (\$0.003/primer) compared to commercial primers (\$0.04/primer), or about a 10:1 cost advantage.

Primers made from strike-anywhere matches

This method is easy, relatively safe and unlikely to get you on a federal watch list. In fact, this is the method that the military teaches its troops for making improvised ammunition. The resulting primers are more energetic than cap primers, but still significantly less than commercial primers. The main problem with this method is finding good strike anywhere matches. The only part of the match that is used to make the primer is the white tip which seems to have shrunk in recent years. The only ones readily available are from Diamond which are green with a small white tip. It takes 3-4 matches to make a single SP primer. Here are the steps for making cap primers:

Materials needed: a) Strike anywhere matches, b) razor blade or sharp knife, c) hammer (optional), d) bamboo skewer (optional),

1. Working on a non-porous surface, carefully cut off the white tips of 3-4 matches using a razor blade or sharp knife. For safety and because it is so easy to set this compound off, only process enough matches at a time to make one primer. Only the white part is wanted, so be careful to only remove this part of the match.
2. Using the flat face of a hammer and a rolling motion, carefully crush the white compound into a fine powder. Alternatively, use the razor blade to chop the white tips into a powder.
3. Fill a primer cup with the loose white powder and pack the powder tightly using the end of one of the match sticks or a bamboo skewer. Add more powder and repack until the cup is 1/2 to 5/8 full of packed powder.

4. Finally, place a saved anvil over the cup and carefully/slowly push it into place using the side of your needle nose pliers. As with the cap primers, lightly moistening the match powder with 90% isopropyl alcohol will help avoid accidental ignition while pressing in the anvil. After the alcohol and water evaporates (at least several hours or leave overnight to be sure they are dry) the match primers become sensitive again and will work like normal.
5. Save your completed primers in an empty primer box, or use them as normal in making ammunition. When made correctly these primers have excellent reliability. The main disadvantage is the slow preparation technique. It can easily take 5-10 minutes to prepare a single primer.
6. The cost of making match primers is low (\$0.015/primer) compared to commercial primers (\$0.04/primer), or about a 2:1 cost advantage.

Primers made with H-48 compound

This method uses a real primer compound and carries some safety risks. It is also likely to get you on a federal watch list since several chemicals common to the fireworks industry must be purchased. The resulting primers are as energetic as commercial primers and should reliably ignite all powders. A few modifications to the formulation can further improve the stability and reliability of the primer. Here are the steps for making H-48 primers:

Materials needed: a) Potassium Chlorate powder, b) Antimony Sulfide powder, c) Sulfur powder, d) finely ground glass preferably pyrex (consistency of flour) or grit) Sodium Bicarbonate powder (i.e. baking soda), f) Scale that weighs in grains, g) plastic weighing boats, h) SS or plastic spatula for transferring chemicals, i) plastic spoon, j) bamboo skewer with a flatten end and a powder scoop carved from a bamboo skewer, k) paper disks punched out of ordinary copy paper that will fit inside the primer cup, l) dilute shellac solution in denatured ethyl alcohol (~1 part shellac in 10 parts of alcohol but the exact concentration is not critical), m) Aluminum powder (60-100 mesh) optional, n) needle nose pliers, and o) small rod or tiny screwdriver (diameter of shaft ~1/16" or smaller)

1. Using 4 plastic weigh boats and a suitable scale, weight out the following materials:
 - a. Boat 1, 17.0 grains of potassium chlorate,
 - b. Boat 2, 9.0 grains of antimony sulfide,
 - c. Boat 3, 4.0 grains of ground glass, and
 - d. Boat 4, 3.0 grains of sulfur, 0.2 grains of sodium bicarbonate (helps stabilize the mixture on extended storage) and 0.2 grains of aluminum powder

The aluminum powder is optional, but provides extra incandescent particles to help ignite slower gunpowders. Aluminum powder is commonly used in commercial Magnum primers for this same purpose.

2. Put ingredients “b”, “c”, and “d” on a plain 8 1/2 x 11 sheet of paper and mix thoroughly using the back side of a plastic spoon. The pile of powder may also be rolled back and forth on the paper to aid in blending the ingredients. These ingredients (and only these ingredients) are safe to mix together without special precautions. *****IMPORTANT: DO NOT ADD ingredient “a” until instructed below*****
3. Collect the thoroughly mixed powder from above into a single pile by lifting up the edges of the sheet. Now pour ingredient “a” into a separate pile on a clean area of the sheet that is beside but not contacting the previous pile. Using the backside of the plastic spoon, crush any lumps in ingredient “a” and make a smooth free flowing powder. **DO NOT MIX ingredient “a” with the other ingredients until this crushing step is completed.**
4. Now, lift up the edges of the paper sheet and roll the two piles of powder into one another. Once these powders are combined, the mixture becomes explosive so be very careful to avoid sparks or any rapid crushing action. Using only this rolling action on the paper sheet, continue to mix the powders until a homogeneous mixture is formed. The backside of the plastic spoon can be used to gently breakup any agglomerated lumps of powder that are found during this blending step. The final result is ~33 grains of light gray powder that is H-48 primer compound. It may be stored in a small plastic condiment cup with a snap on cap until ready for use. This amount of primer compound is sufficient to make ~100 SP primers or ~60 LP primers. The H-48 primer compound can be tested (preferably outside) by placing a small amount (about what fits in a SP cup) on a smooth metal surface and striking it with a hammer. Properly made H-48 compound will explode with a report about like a large firecracker and can make your ears ring for several minutes. With that in mind, consider the potential power of a full 33 grain batch going off (~100 times what you just set off!) Respect the primer material and work safely to prevent accidents. *****WARNING! DO NOT MAKE OR STORE LARGER AMOUNTS OF H-48 PRIMER COMPOUND*****
5. Position 10-25 prepared primer cups onto the edge of a 6” x 6” sheet of waxed paper. In the middle of the sheet, pour out about 1/4 of the batch of primer compound made previously and recap the container. Using the carved bamboo scoop, position an empty primer cup next to the pile and add H-48 primer compound until the cup overflows. Using the side of the scoop, remove the excess powder so that the powder is level with the top of the cup. Move this filled cup to the edge of the wax paper sheet and repeat the operation until all of the cups are filled.
6. Using the bamboo skewer with a flattened end, position a filled cup close to the edge of the wax paper sheet and carefully pack the powder tightly. The cup will be ~1/2 full of packed powder when this step is completed. This is exactly the correct amount of powder that needs to be used in the primer and is why I prefer the dry packing method. It is ~21 mg or ~0.3 grains of primer compound in a SP primer. LP primers will contain ~35 mg or ~0.5 grains of H-48 compound. It is possible to refill the 1/2 full cups with H-48 powder and repack to make them 3/4 full. While this will make a more energetic primer, it is very difficult to install the anvil when the cup is this full. Repeat this operation until all of the cups are packed.

7. Place a paper disk over the packed H-48 compound in each cup and pack the powder one more time. Moisten the primer pellet with dilute shellac in ethyl alcohol solution using a small pointed rod or tiny screwdriver to transfer small drops of solution to the cup until the paper disk just stays moist (don't overdo it.) This step desensitizes the primer compound so that the anvil can be safely installed and binds the powder into a solid pellet once the alcohol dries. This moistening step is critical in making reliable H-48 primers. Place a saved anvil over the cup and carefully push it into place using the side of your needle nose pliers. Finally, move the completed primers to a well-ventilated area so that the alcohol can completely evaporate (overnight works well).
8. Save your completed primers in an empty primer box, or use them as normal in making ammunition. When made correctly these primers have excellent reliability and energy (very close to commercial primers.) This same technique can be used to reload berdan primers, minus the anvil step. It takes about 30 minutes to process 25 primers from start to finish. Completed H-48 primers have about the same stability/sensitivity as standard commercial primers.
9. The cost of making H-48 primers is very low (\$0.0003/primer) compared to commercial primers (\$0.04/primer), or about a 100:1 cost advantage.

Making Non-Mercuric/Non-Corrosive Primers

It is not practical to make typical non-mercuric/non-corrosive primer mixtures for the following reasons:

The required compounds cannot be purchased/shipped.

They must be synthesized from basic raw materials. Even if you were a chemist with the proper training to make these compounds, it would require a wet chemistry laboratory with the appropriate safety systems for handling explosives. The reactions would also generate hazardous waste products that must be safely disposed of. Few people have access to the appropriate facilities to make these compounds. As noted earlier, individuals are often unable to purchase many of the needed chemicals due to government restrictions. Trying to purchase certain restricted chemicals is guaranteed to put you on some federal watch list. You might even get your phone tapped and/or get a personal visit from some federal agents wanting to know what you are up to.

Special storage conditions for these materials are required

These chemicals are very high energy and surprisingly small amounts can cause serious injury/death. Once they have been synthesized, they must be stored in special magazines that limit the damage should the material accidentally explode. These are the same type of magazines that are required to store fireworks and large amounts of black powder.

In addition, many of these compounds are also poisonous and have serious health risks. It is unlikely that these materials could be safely stored in a residence. Doing so anyway would be the most likely reason for you to get into legal trouble.

Special mixing facilities are required to safely combine and mix the primer components together.

Safely (again a relative term considering the chemicals we would be working with) mixing these primer components together requires blast proof equipment located in an isolated area. Any stray spark, or even a stirring paddle contacting the side of a mixing vessel can set off a spectacular explosion.

Special facilities (e.g. blast proof building) are needed to wet load primer compounds into primer cups.

Again, a dedicated isolated building built to withstand an explosion would be needed to wet load the finished primer compound into the prepared primer cups.

Drying facilities are required to remove water from loaded primer cups.

Wet loaded primers need to be dried in a spark free oven with good air flow. It might be possible to use a food dehydrator, setup on your outside picnic table and remotely powered up.

Finished primers must be safely stored.

Save your old primer boxes to hold the homemade ones. You can't just pour them loose into a container.

Testing of primer batches may be required to assure they work correctly

Proper quality control of a batch of primers requires that randomly selected primers be tested for correct function.

Appendix

References

Ammunition Making – An Insider's Story, George E. Frost, NRA, 1994

Poor Man's Primer Manual, George B. Dmitrieff, Desert Publications, 2001

Explosives Engineering, Paul W. Cooper, Wiley-VCH, 1996

Priming Compounds, Bev Fitchett's Guns Magazine, <http://www.bevfitchett.com/chemical-analysis-of-firearms/priming-compositions.html>

Hatcher's Notebook, Julian S. Hatcher, The Military Services Publication Company, 1947

Improvised Primary Explosives, Dirk Goldman, Internet, 1998

Manual of Explosives, Military Pyrotechnics, and Chemical Warfare Agents, Jules Bebie PhD, MacMillan, 1943

Ordnance and Gunnery, Ormond Michell Lissak, John Wiley and Sons, 1908

Primer mixes composition and behavior, Marco Morin PhD, 2008,
http://www.academia.edu/3157491/Primer_mixes_composition_and_behaviour

Improvised Munitions Handbook, TM 31-210, Department of the Army, 1969

....plus too many patents to mention

Primer chemical suppliers

There are a large number of online chemical suppliers for the closely related fireworks hobby. They carry almost everything you will need. Prices and shipping charges vary widely, so comparison shop before buying. Also, most of these suppliers require that oxidizers (e.g. potassium chlorate) and fuels (e.g. antimony sulfide and sulfur) be shipped (and sometimes even ordered) separately which increases the shipping costs. The more general laboratory suppliers, like CitiChemical and Elemental Scientific also carry glassware and other laboratory equipment that may prove useful. Also, be sure to checkout Amazon and eBay as they carry a surprising number of chemicals and laboratory equipment. I have personally purchased chemicals from Hobby CS, Pastime, Amazon, and eBay.

Skylighter	http://www.skylighter.com/mall/chemicals.asp
Hobby CS	http://www.hobbychemicalsupply.com/servlet/StoreFront
Thunder	http://www.highqualitychems.com/servlet/StoreFront
PyroChemSource	http://www.pyrochemsource.com/Chemicals-Chemicals-AL/b/4940415011
FireChemical	http://www.firechemical.com/
Pastime	http://pastimepyrochemicals.com/
American Pyro	http://www.americanpyrosupply.com/Products-PYROTECHNIC_CHEMICALS.html
CitiChemical	http://www.chemsavers.com/
Elemental Scientific	http://www.elementalscientific.net/store/scripts/default.asp
Amazon	http://www.amazon.com
eBay	http://www.ebay.com
Ace Hardware	for shellac and denatured ethyl alcohol, also available from Lowes, Home Depot

Primer formulations

H-48 Primer Compound

Potassium chlorate	51.5%
Antimony sulfide	27.3%
Sulfur	9.1`%
Glass powder	12.1%
Sodium Bicarbonate	trace (optional)
Aluminum powder	trace (optional)

H-42 Primer Compound (used for almost all WW1 military ammunition)

Potassium chlorate	47.2%
Antimony sulfide	30.83%
Sulfur	21.97`%

This formulation removes the ground glass used in H-48 that was suspected of causing excessive barrel wear. This is an unproven suspicion and probably not true because of the fineness of the ground glass (more likely to act as a polishing agent than an abrasive.)

FA-70 (used from 1917 until mid-1950's by the US military)

Potassium chlorate	53.0%
Lead Thiocyanate	25.0%
Antimony sulfide	17.0`%
TNT	5.0%

Note: a finely ground fast pistol powder can replace the TNT in this formulation.

Lead Thiocyanate is a restricted (and expensive, \$45/lb) chemical and must be synthesized to make this formulation. This primer mixture has better storage life than H-48 or H-42 compounds because of the replacement of sulfur by lead thiocyanate.

Synthesis of primer chemicals

This is a high level subject that will left for an advanced course. However, if you are interested, the Internet can provide you with all the information you need. Patents are especially useful and easily accessible.