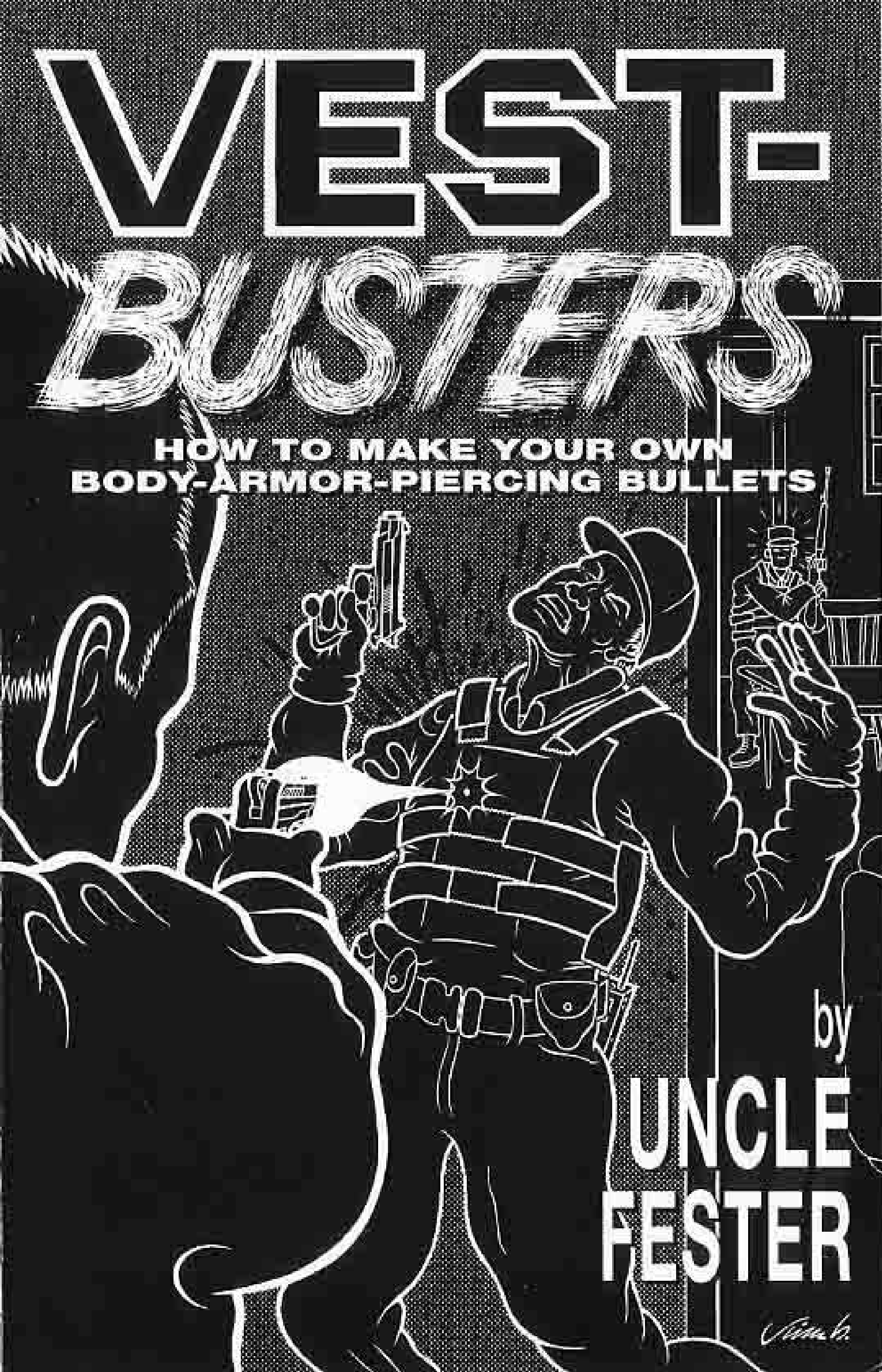
VEST-
BUSTERS
HOW TO MAKE YOUR OWN
BODY-ARMOR-PIERCING BULLETS
by
UNCLE
FESTER

# VEST-BUSTERS

## How To Make Your Own Body-Armor-Piercing Bullets

Uncle Fester

Festering Publications
Green Bay, Wisconsin

Vest-Busters: How To Make Your Own Body-Armor-Piercing Bullets



**Published by:**
Festering Publications
826 S. Baird St.
Green Bay, WI 54301

Cover design by Jim Blanchard

**ISBN 0-9701485-1-8**

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# Preface

Recent years have seen the flowering of a most disturbing trend in this country. That trend is the increasingly common surprise attacks against the citizens of this country by marauders who are heavily armed, and who need not fear for the natural consequences of their acts, because they themselves are protected against return fire due to the wearing of body armor.

Many of these marauders operate under the auspices of "law," and feel free to commit the most heinous acts of cold-blooded murder because they have been indoctrinated with the beliefs that their loyalty is owed to "the system," and that the populace is the enemy who must be controlled. This belief is quite convenient for the masters who control "the system" and who also assure that their hired assassins will suffer no legal consequences, no matter how wanton the act. At the time of this writing, the deliberate mass burning deaths of the members of the Mt. Carmel Church in Waco have garnered the perpetrators of this act promotions and praise from their masters, rather than rebuke and punishment. Ditto for the snipers who cold bloodedly decimated the Randy Weaver family in Idaho.

Examples of officially sanctioned murder are now far too numerous to list in this preface. The fact of the matter is that the surprise dead-of-the-night, guns blazing ambush assault is now standard operating procedure nationwide. Even in my own small, backwater hometown, a 67-year-old man (wanted for not showing up for his court date to answer the charge that he deliberately ran over someone's parked motorcycle) had his home descended upon in the dead of night. When he flung some lead at those breaking into his house, he was shot dead. They wore armor.

The now nationally standard garb of American death squads is deliberately chosen to instill terror into the populace, who, after all, are the enemy, and must be controlled. It is a blend of the black hood associated in the popular mind with executioners and terrorists of various stripes, and the black uniform of the SS, complete with bucket helmet and jackboots. The people who designed this uniform are not stupid; rather, they are evil — and they topped this uniform off with a modern addition: body armor which is invulnerable to standard bullets.

The criminal element has similarly grasped the value of wearing armor when committing crimes. In this way, they are safe from gunfire from both the police and their victims. The result of this trend is the *de facto* repeal of the Second Amendment. The framers of our Constitution did not guarantee the people the right to keep and bear arms so that they could go duck hunting. Rather, it was their intent that the people be armed so that they could be secure in their homes, and assist in the national defense against enemies foreign and domestic. James



Madison, the Constitution's chief author, said of the Second Amendment: "The American people are unique among all the people in the world because they need not fear their government — they are armed in a manner similar to any force the government may send against them." Clearly, the intent was that an armed populace be a counterweight against the natural tendency of governments to evolve toward tyranny.

The widespread use of body armor leaves the people with two options to avoid being, for all practical purposes, disarmed. The first option is, to quote from G. Gordon Liddy: "Shoot for the head!" In the real world, this is an unworkable option. The head can be a very small target indeed; on some people vanishingly small. Hitting such a target is challenging enough under target practice conditions. During an adrenaline-filled, life-or-death nightmare, when one's home has been broken into and evildoers intent upon your demise have opened fire on you, it is damn near impossible.

For this reason the second option will be explored in this book. This option is the home manufacture of bullets capable of defeating armor.

With these bullets, most armor is penetrated with ease. The proper balance of power is then thereby restored in favor of those defending home and hearth. Teflon coating of bullets is a fairly simple and inexpensive task, one which turns useless metal slugs into potent defenders of self and family. You, the reader, will gain greatly from my years of experience as a chemist in the metal finishing field. You will be quite pleased, I'm sure!

*Uncle Fester*



# Part One: Principles of Penetration

*"Firearms stand next in importance to the Constitution itself."* — **George Washington**

*"To disarm the people is the best and most effectual way to enslave them."* — **George Mason**

*"I have never seen a deer, a duck or a wild turkey wearing a Kevlar vest in my life."* — **President Bill Clinton,** in a speech proposing a bill expanding the federal ban on "cop killer" bullets that can penetrate bulletproof vests.

The manifest desire of those in control to assure that we peons out here are sufficiently disarmed so that we pose no danger to their hired thugs is far from a novel idea. As a matter of fact, ruling classes throughout the world and over the ages have made it a point *de rigueur* to assure that the peasantry would be defenseless against its arm of civilian control. As our Founding Fathers knew from experience, the disarmament of the populace is a necessary prerequisite to tyranny. A bit of schoolyard psychology helps to illustrate this point. When one's job as "agent of authority" revolves around harassment, predation and control, rather than "to serve and protect," those attracted to the job will be of the bully's mindset. We all know from experience that bullies abhor picking fights in which they might get their butts kicked. The prospect of getting their butts kicked regularly would make recruiting for the job of "agent of control" very difficult indeed. Therefore, an effectively armed populace and governmental tyranny are mutually incompatible. Some examples from history are very instructive on this point.

During the Middle Ages, peasants in Europe were forbidden to possess crossbows. The penalty for violation was a miserable, torturous death. The reason for this prohibition was because a crossbow propelled an arrow with enough force to penetrate a knight's armor. Tales of chivalry aside, a knight's job was mainly to keep the lord's serfs in line and paying taxes. Job perks included plenty of rape and pillage when anyone dared step out of line, or when the mood struck. As you could imagine, the unsavory types attracted to this line of work would quickly find other ponds to prowl if fear of lethal perforation was lurking constantly in the backs of their minds, throwing cold water on those libidinous dreams of rapine. Of course, the common folk were allowed to keep regular, low-powered bows and arrows, as they were useful for hunting. Sounds familiar, doesn't it?

Along similar lines, we've all watched those dreadful B movie imports from Japan glamorizing the samurai as super-chivalrous and noble folk who wave colored hankies to each other before doing battle. Yet, even with such wonderful gents looking



over them, possession of swords was forbidden to common Japanese for very familiar reasons. The karate, kung fu, and other related Eastern methods of self-defense all arose as a response by a disarmed populace to the wanton excesses of their masters and their dogs of war against the civilian population — the samurai and their equivalents throughout the Far East.

Skipping a bit of history to come to our own 20th century, we encounter the most heinous examples of mass slaughter against unarmed civilians even seen in human history. Our own century is the shining proof of the fact that government run amok is the greatest danger a common person has to his life, family, and property. A disarmed populace is like a flock of sheep upon which the wolves of tyrannical government can prey at will. The hapless victims will henceforth be referred to as "sheeple," for lack of a better term.

There have been approximately 65 million unarmed sheeple slaughtered during the 20th century by various governments. In each case, the disarming of the victim population was the necessary prerequisite to their demise. The disgusting sight of European Jews and other "undesirables" meekly packing themselves into boxcars on the way to Nazi slaughterhouses is one prime example of the kind of mercy that the weak and disarmed have come to expect from barbarous overlords. The six million Nazi victims pale beside the multi-millions similarly led off to slaughter in Communist Russia and China.

One can add to this list: a couple million Armenians exterminated by the Turks during WWI; a few million Cambodians done in by their communist masters; a half million or so Rwandans; the century-long terrorization of an island full of Haitian rabbits by a small armed band of thugs; and, an unknown number of "ethnically cleansed" Yugoslavians.

None of these crimes would have been possible against an armed citizenry. The silly people out there with rabbit-like spirits will likely question at this point, "So if a gang of storm troopers come to my house to take me and my family away to their slaughter facility, what good would being armed do me? If I shoot it out with them and maybe get one or two of them before they finish off me and my family, how am I ahead? I'm still dead." This line of logic fails to take into account the mentality of those who would be willing to commit such acts. They are not soldiers, they are thugs and bullies, and incurring casualties will quickly evaporate their zest for the activity. Further, one must also consider that one is likely not to be the only one on the block targeted for elimination, should an officially decreed mass slaughter take place. One can reasonably expect armed support from those wearing similar targets upon their chest, when the boot comes to kick in your door. This is why an armed people can't be successfully targeted for a one-way ride in a boxcar.

In these United States, the process of disarming the people has taken the incremental path. The goal of this incremental disarmament is to remove from



the hands of the people the firearms most useful in resisting heavily armed and body-armored gangs. It shouldn't help you sleep well at night knowing that this process continues unabated, regardless of the party in control of the White House or Congress. Its underlying roots are the desire of those in control to assure a prostrate and compliant sheepledom.

The justifications presented to us for this disarmament are the need to fight crime, and that guns are responsible for criminal acts. I've always been amused at people who will blame an inanimate object for something. In my own state of Wisconsin as I write this, hundreds of thousands of deer hunters are roaming through the sticks heavily armed, many of them quite drunk. There will not be a single incident of a hunting party shooting it out with another over turf or some perceived slight. Those maladapted punks who make a hell out of their inner-city neighborhoods by engaging in such activity are the deliberate creation of Big Brother's social welfare meddling. They serve their purpose well by acting as the Boogie Man, in order to scare the sheeple into accepting gun confiscation. Never mind that only the compliant sheeple would actually turn over their guns, leaving themselves disarmed against both these previously mentioned punks and the jackboots of Big Brother. Recent world history makes it quite clear that we're much better off taking our chances with the punks.

Following the ban on so-called "assault weapons," the disarmament drive at present is centered upon two related items: "sniper rifles" and the so-called "cop killer bullets." Their correlation is that in both instances, the drive is to ban weapons which can defeat body armor. The "sniper rifle" defeats armor by brute force, and the "cop killer bullets" penetrate Kevlar body armor by means of force, construction, or a combination of the two.

Obviously, a "bulletproof vest" is not immune to penetration. After all, it is just layers of Kevlar fabric, sometimes fortified with a backing of steel plates. This flimsy barrier pales in comparison to the thick steel or composite armor found on tanks, yet we all know that tank armor is far from invincible.

Exactly how resistant a given vest is depends upon a variety of factors. The first and most important factor influencing the performance of a given vest is its design and construction. Vests vary widely according to model in the crucial details such as the number of layers of Kevlar fabric contained in the vest, how the stitching is done, and the presence or absence of a metal plate backing for the Kevlar fabric.

There is a rating system for vests which ranks them according to their ability to stop projectiles. A "type I" vest, generally consisting of about eight layers of Kevlar, will stop low-velocity handgun bullets, such as those fired from a .38, and small bullets such as those fired from a .22 or .25 caliber handgun. This thin armor is generally used as fashionable form fitting underwear by those who consider themselves likely to attract random bullets.



The "type II-A" armor contains about 16 layers of Kevlar, and so is not as flattering to the figure. It will stop a .22 rifle bullet, a .38 special and super, 9mm rounds which are not full-metal jacketed, and 12-gauge buckshot. The better constructed "type II" armor will, in addition, stop a .357 magnum or .44 magnum firing the jacketed, soft-point rounds.

Beyond this, there is the "level III," which can be attained by the addition of hard plates to the vest. It will stop the 9mm full-metal jacketed round, a 12-gauge slug, the .30-06 soft point, and the .308 Winchester full-metal jacketed round. There is even a "level IV," which will stop a .30-06 full-metal jacket, and NATO and Russian rounds.

There is a very important rule of thumb which the reader should learn and never forget: Teflon coating of a given bullet will raise its penetration one class level. For example, a Teflon-coated .38 will defeat a "level I" vest, and a Teflon-coated .22 rifle bullet will penetrate "type II-A" armor.

From the above examples, it should be obvious to the reader that a variety of factors determine how effective a given round will be when it encounters body armor. Foremost among these factors is the amount of "wallop" or kinetic energy the bullet carries with it when it encounters the armor barrier.

$$KE = \tfrac{1}{2}mV^2$$

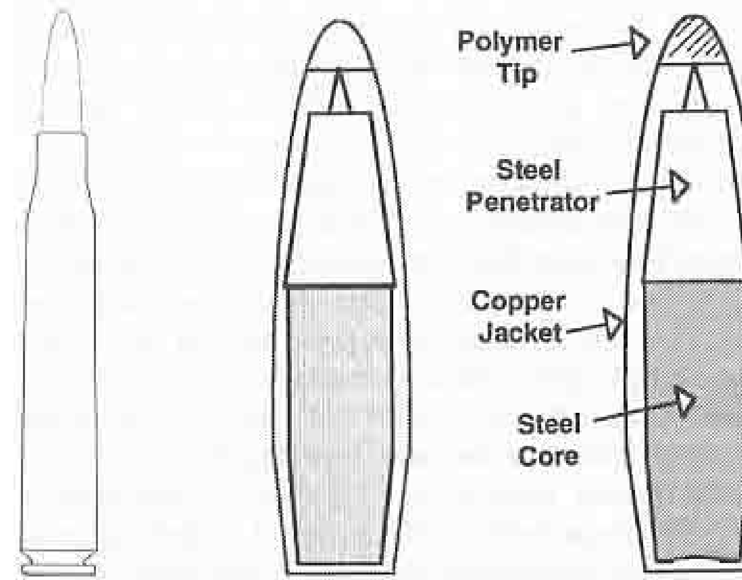
From this follows the fact that most handguns are ineffective against commonly encountered armor.

The small load of powder in the cartridge, and the short length of travel down the barrel that the burning powder has to accelerate the bullet, results in a low projectile velocity. The velocity is by far the overriding consideration. When calculating the kinetic energy carried by the slug, because, as shown in the formula on page 11, kinetic energy increases by the square of velocity, while it is only directly proportional to mass. Increasing the velocity of a bullet does much more to punch it through armor than increasing its weight.

A corollary to this effect dictates that as a given bullet slows down during its flight toward the target, it rapidly loses lethal perforation capability. The reader should further note that one of the benefits of Teflon-coating a bullet is that it eliminates friction as the projectile moves down the barrel of the gun, allowing considerably higher velocities to be achieved by the time it exits the gun barrel. This higher velocity, with its correspondingly higher kinetic energy, is partly responsible for the armor-defeating qualities of Teflon-coated bullets.

Of course, we could have all guessed that an elephant gun at close range would stand a better chance of defeating body armor than a slug from a .22 Saturday Night Special fired through a door. So what else determines the performance of a bullet when it meets a vest? The answer to that is bullet construction. For illustration, study the .223 (5.56mm) round pictured on the next page.






This round is still legal as of mid-96, because it is meant to be fired from a rifle. It also exemplifies good construction of a body armor-defeating round which is commercially available. What are we looking at in this round which makes it good and also lacking from many other rounds? To answer that one must consider two other factors that will often make a given bullet useless against armor: flattenability and splinterability.

Many bullets are purposefully designed either to flatten out when they strike an object (called mushrooming) or to break apart into flying splinters. This design causes them to do a great deal more damage to body tissues than an intact bullet whizzing right straight through. It helps to ensure that the entire kinetic energy load of the bullet is transferred to the soft flesh it encounters. It also ensures that the slug will perform poorly against Kevlar armor.

The .223 round pictured on page 13 is specifically designed *not* to flatten or break into splinters upon impact. The first thing to note about this bullet is that it has a full-metal jacket, as opposed to a soft point, or even worse, a hollow point. The full-metal jacket helps the bullet to maintain its shape on striking something, while the soft point would flatten, and the hollow point would splinter.

Further note that the bullet actually comes to a point. It almost looks as if you could pick your teeth with it. This allows the point of the bullet to defeat the Kevlar fabric a few fibers at a time, and work its way through. Once a bullet flattens, many fibers can come into play to slow and then stop the bullet. This sharp-point factor is most clearly illustrated by the vulnerability of Kevlar vests to ice picks and stilettos. These very fine sharp points can penetrate with just hand power. How do you think they are able to stitch these vests together?

The next thing to note about this bullet is the steel core just behind the point of the bullet. Nearly all bullets have a core made of lead. Lead, being a very heavy metal, gives the bullet added weight. This added weight improves its flight characteristics, keeping the bullet on track through brush, leaves, twigs and crosswinds. It also gives added momentum to the round.



$$M = mV.$$

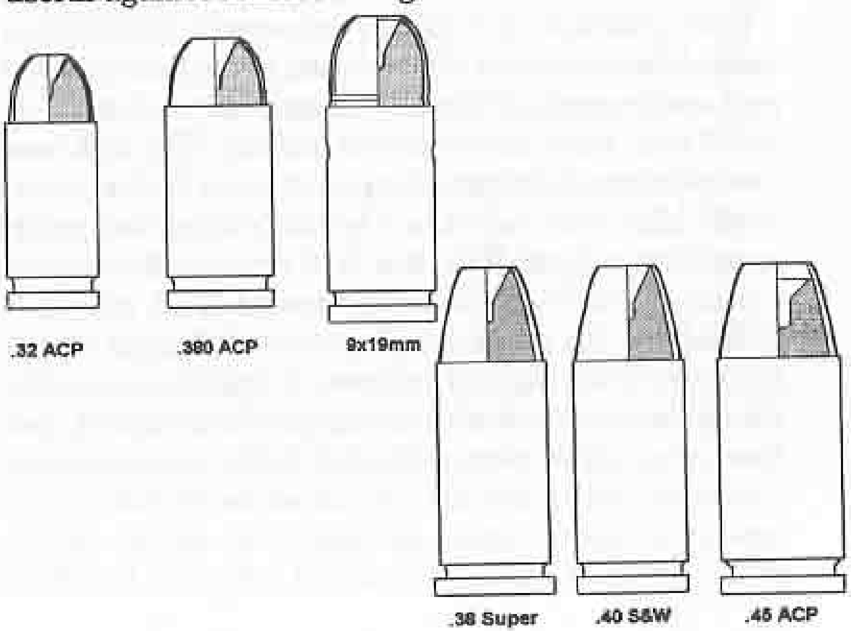
Lead is also very soft. You can almost bite through a piece of lead. This softness causes easy flattening of the projectile when it strikes an object. The steel core behind the nose of the bullet helps the point maintain its shape.

Further, note the large charge of powder contained in the cartridge for propelling this projectile. The specification sheet for this bullet claims a muzzle velocity of 3,000 feet/sec, carrying a kinetic energy of 1,240 ft-lbs. This bullet is capable of penetrating "type III" body armor as sold, right out of the box.

How could such a bullet be improved? Obviously, a coat of Teflon would likely make it capable of lethal perforation against "type IV" armor. Beyond that, we could ask, what are its weak points? The first and most obvious hindrance to penetration is the jacket itself. Like most full-metal jacket bullets, the jacket is made of copper. This is a fairly soft metal, though not as soft as lead. Since the jacket is so soft, it is difficult for the point to maintain its integrity once it strikes something. Of course, a solid steel bullet would be better suited to defeat body armor, but there is a reason why solid steel bullets are not seen. The solid steel grinding upon steel as the bullet flies down the barrel would quickly wear out the barrel unless it was heavily plated with chrome. A Teflon-coated steel bullet wouldn't suffer from this drawback, as the soft Teflon would protect the rifle barrel.

Now that the reader has a basic understanding of the desirable qualities possessed by bullets capable of making headway against body armor, we shall next move on to some examples of commercially available ammunition, and judge them as to their suitability for use against vested targets, and the ease with which they may be Teflon-coated to improve their penetration performance.

Below are depicted a series of commonly available handgun rounds, along with technical data on each, detailing their construction, weight, muzzle velocity and kinetic energy carried. Pick out the bullets most useful against armored targets.






**Winchester Handgun Cartridges**

| Cartridge | Bullet Wt. Grs. | Bullet Style | Muzzle Velocity (F.P.S.) | Muzzle Energy (Ft/lbs) |
|---|---|---|---|---|
| .32 ACP | 60 | STHP | 970 | 125 |
| .380 ACP | 85 | STHP | 1000 | 189 |
| 9mm Luger | 115 | STHP | 1225 | 383 |
| 9mm Luger | 147 | STHP | 1010 | 333 |
| .38 Super Auto (+P) | 125 | STHP | 1240 | 427 |
| .38 Special (+P) | 95 | STHP | 1100 | 255 |
| .38 Special | 110 | STHP | 945 | 218 |
| .38 Special (+P) | 125 | STHP | 945 | 248 |
| .357 Mag. | 145 | STHP | 1290 | 535 |
| .40 S&W | 155 | STHP | 1205 | 500 |
| 10mm Auto | 175 | STHP | 1290 | 649 |
| .41 Rem. Mag. | 175 | STHP | 1205 | 607 |
| .44 S&W Special | 200 | STHP | 900 | 360 |
| .44 Rem. Mag. | 210 | STHP | 1250 | 729 |
| .45 Auto | 185 | STHP | 1000 | 411 |
| .45 Colt (not shown) | 225 | STHP | 920 | 423 |

* STHP = Silver Tip Hollow Point

If you answered that none of these bullets would be useful against an intruder wearing a Kevlar vest, go to the head of the class. All of the rounds listed above are hollow-point bullets, and so by construction they are all unsuitable choices regardless of their muzzle velocity or carried kinetic energy. Teflon coating is unlikely to improve their performance very much.

Now let's try another example:

**Hanson Handgun Cartridges**

| Cartridge | Bullet Wt. Grs. | Bullet Style | Muzzle Velocity (F.P.S.) | Muzzle Energy (Ft-lbs) |
|---|---|---|---|---|
| 9mm Luger | 115 | FMJ | 1155 | 340 |
| 9mm Luger | 115 | JHP | 1160 | 342 |
| 9mm Luger | 147 | FMJ | 985 | 318 |
| 9mm Subsonic | 147 | FMJ | 985 | 318 |
| .38 Spec (+P) | 125 | JHP | 940 | 245 |
| .38 Spec. | 148 | WC | 710 | 228 |
| .38 Spec. | 148 | HBWC | 755 | 200 |
| .38 Spec. | 158 | LSWC | 760 | 200 |
| .357 Mag. | 158 | JSP | 1220 | 522 |
| .357 Mag. | 158 | JHP | 1250 | 549 |
| .40 S&W | 180 | JHP | 987 | 390 |
| .40 S&W | 180 | FMJ | 987 | 390 |
| .44 Mag. | 180 | JHP | 1610 | 1036 |
| .44 Rem Mag. | 240 | JHP | 1180 | 740 |
| .45 ACP | 185 | JHP | 930 | 355 |
| .45 ACP | 230 | FMJ | 880 | 395 |
| 50 AE (20 rds/box) | 300 | JHP | 1579 | 1568 |
| 50 AE (20 rds/box) | 300 | JSP | 1579 | 1568 |



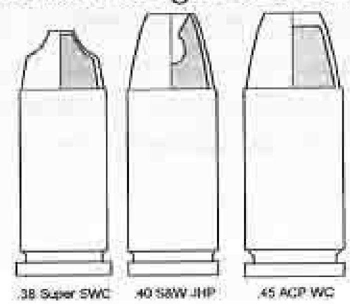
**Hanson Rifle Cartridges**

| Cartridge | Bullet Wt. Grs. | Bullet Style | Muzzle Velocity (F.P.S.) | Muzzle Energy (Ft-lbs.) |
|---|---|---|---|---|
| 7mm Mauser | 175 | FMJ | 2440 | 2315 |
| .308 Win | 125 | SP | 3028 | 2549 |
| .308 Win | 150 | SP | 2853 | 2712 |
| .308 Win | 150 | FMJ | 2795 | 2596 |
| .308 | 165 | SP | 2678 | 2640 |
| .308 | 180 | SP | 2558 | 2616 |
| .30-06 | 150 | SP | 2950 | 2898 |
| .30-06 | 165 | SP | 2800 | 2870 |
| .30-06 | 180 | SP | 2670 | 2850 |

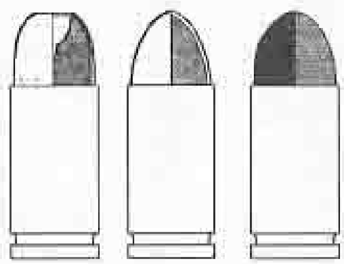
FMJ = Full-Metal Jacket, JHP = Jacketed Hollow-Point, WC = Wadcutter, JSP = Jacketed Soft-Point, SP = Soft-Point, HBWC = Hollow-Base Wadcutter

In this case, only certain bullets are the rounds to choose for use against an armored intruder: they are the 9mm Luger, the .45 ACP, the 7mm Hauser, and the .308 Winchester, all in the full-metal jacket configuration.

Now that we have covered some of the basics, let's move on to more advanced bullet studies. Below are three rounds in order of increasing caliber. Pick the rounds suitable for use against an armored target.



The answer here is the .38 Super SWC, and the .45 ACP WC. The hollow point on the .40 S&W JHP will cause this round to smooth out like a pat of butter when encountering Kevlar armor. Now consider this series of .45 caliber bullets:




In this case, only the FMJ(Ball) round is a suitable choice. The round nose lead is just too soft, and the JHP is even worse. The .45 ball ammo is an excellent load, if one could only get it moving fast enough. This point should not be lost on those of you who have a .45 Thompson submachine gun. The muzzle velocity of the round leaving that weapon is much higher than when it leaves the .45 handgun.

Finally, let's consider a series of rifle rounds:


.223 jacketed with exposed tip

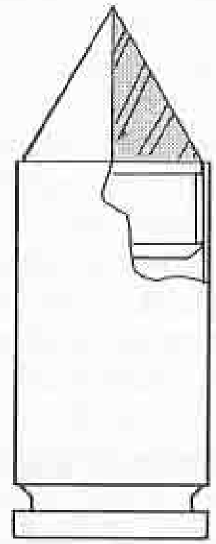

.308 "NATO ball" (FMJ)


.30-30 FMJ



Here we have two candidates, with the .308 Nato ball (FMJ) getting one thumb up, and the .30-.30 FMJ getting two thumbs up. The larger charge of powder gives the .30-.30 the advantage.

A further lesson can be learned from a French round called the "Arcane."




This round has better vest penetration capability than any round covered so far in this book. Why would that be? First of all, there is no lead core in this round. It is lathe-turned out of solid bronze. This contributes greatly to maintaining the rigidity of the bullet when it encounters resistance. Also, note the no-nonsense point on it. As a result, it needs to defeat less of the vest to gain penetration. The reader should be warned that this round is illegal if fired from a handgun. In the near future, it may be impossible to obtain loaded Arcane rounds for a rifle either.

Obviously, the handgun rounds are going to be much less effective than the rifle bullets because of their lower speed and less streamlined construction, but the handgun is so well-suited for home defense that one must not ignore the prospect of having to use one against Kevlar. The handgun and the sawed-off shotgun are particularly well-suited for use in a home defense situation, because they don't have a long barrel, which could easily be grabbed by an intruder when one is coming through a doorway or around a corner in one's home while a defender is doing battle against these invaders. At least a few clips of Teflon-coated, high-powered and suitably constructed handgun rounds should form the last line of defense for your castle/home sweet home.

## The Ultimate Penetrator

The discussion up to this point has mostly centered around commercially available slugs as the matrix upon which to apply Teflon-coating to improve their performance. One need not be so limited in choice. As was mentioned in passing earlier, a solid-steel bullet will greatly outperform its softer commercial cousins in use against Kevlar, not to mention other "bulletproof" materials such as "bulletproof" glass, metal plate, wood, cement, and so on.



If one possesses, or has access to, a metal lathe, turning out steel bullets is a very simple matter. Such lathes are widespread in the metal working industry. In the plating plant where I spend my days, the metal lathe could easily be put to use for such a purpose. I'm sure this condition is not unique.

To produce solid-steel ammunition, one need only load the lathe with steel rod of appropriate diameter (caliber) to be compatible with the gun from which it is intended to be fired. Then bullets can be cut from the rod which possess the sleek, streamlined shape so preferred for slicing through Kevlar armor. There are two main caveats to be heeded in the cutting of custom made bullets. First of all, the bullet must come out perfectly symmetrical in shape along the long axis of the bullet. The reason for this is pretty straight-forward. As a bullet accelerates down the barrel of a gun, the rifling inside the barrel imparts a spin to the bullet. This spin works to stabilize the bullet during flight, much as the spiral on the football keeps the football from wobbling around or going end-over-end to the receiver. Similarly, if the bullet is cut asymmetrically, the excess weight on one side will cause the bullet to tumble wildly in flight, thereby ruining accuracy and preventing the bullet from striking the target pointed nose first. On a good lathe, making a symmetrical cut is no great feat, as long as the steel rod is straight, and doesn't wobble around as it is being cut. Higher quality steel rod produces a correspondingly more formidable projectile, but is also more difficult to cut. Alloy steels of the 4000 and 5000 series are a good compromise between the very easily cut, mild steel on one end of the spectrum, and the exceedingly hard tungsten steel on the other.

The other caveat to be kept in mind pertains to the diameter of the bullet as cut. To apply Teflon to this steel bullet, the steel must first be etched in acid to pit the surface of the metal. These pits form footholds for the Teflon to bond to the metal surface. Copper-jacketed bullets must similarly be etched. Then a layer of Teflon must be applied at least one mil in thickness to get that enhanced penetration effect. The cut must be done so that when the bullet is coated with the desired amount of Teflon, the correct bullet caliber is obtained. There is much more on this in the next section covering the procedures to follow to get a nicely Teflon-coated bullet.



# Part Two: Projectile Preparation

*"A well regulated Militia, being necessary to the security of a free State, the right of the people to keep and bear Arms, shall not be infringed."* — **The 2nd Amendment to the Constitution**

*"I ask you sir, who are the militia? They consist now of the whole people..."* — **George Mason**

*"Wherever standing armies are kept up, and the right of the people to keep and bear arms is, under any color or pretext whatsoever, prohibited, liberty, if not already annihilated, is on the brink of destruction."* — **St. George Tucker**

The home or workshop manufacture of Teflon-coated bullets of very high quality is not a particularly hard, nor involved process. The procedure has long ago been perfected to the point where low-paid, illegal immigrant labor can come into a shop and be turning out good products coated with Teflon with a minimum of training, or even understanding the process. The process is, in a nutshell: degrease, etch, dip, and bake. All of the steps are just as accessible to someone working out of a garage or basement as they are to someone putting in their time on a factory floor.

The chemicals needed to prepare the metal for coating are found in any kitchen or hardware store. Degreasing, for instance, is pretty much identical to washing greasy dishes. Similarly, the all important etch step uses hydrochloric (muriatic) acid right off the hardware store shelf to etch steel projectiles. Copper-jacketed bullets are etched in a mixture of hydrochloric and ammonium nitrate fertilizer to generate *in situ* nitric acid to etch the copper. The dipping and baking steps are also just as simple as they sound.

The original citation for the Teflon-coated bullet is to be found in US Patent 3,580,178 issued to Paul Kopsch in 1971. The surprising finding reported in this patent was that a Teflon coating on a bullet greatly increased penetration solely due to the lubricity of the Teflon coating as it encountered the metal plates, not increased velocity of the bullet due to lack of friction as it accelerated down the gun barrel. Their test ammunition used Teflon as an undercoat between the jacket and the core of the bullet. For an example of the much greater velocity that a Teflon-coated bullet achieves, see US Patent 5,214,237. A bullet that has an outer coating of Teflon possesses both the increased velocity due to lack of friction in the gun barrel, and enhanced penetration ability due to the "greasing" of the bullet as it encounters the target.

A quote from the Kopsch patent reinforces this point:



> "Attempts to increase bullet penetration have generally been directed to three factors: 1. Increasing the hardness of the bullet core; 2. Decreasing the weight of the bullet; and 3. Increasing the velocity of the bullet. One factor, however, which also appears to be extremely pertinent to the performance of metal-piercing ammunition, but which has been generally neglected, is the friction and subsequent resistance generated by the surface of the piercing end or nose of the core as it passes through the target."

The beneficial effect of Teflon coating isn't limited to metal targets. In fact, it's considerably more pronounced when penetrating fibrous substrates such as wood, phone books, walls, and Kevlar. This is just as one would expect based upon common sense.

As was stated earlier, the process of applying a Teflon coating to a bullet is a fairly straightforward procedure. There is one very important caveat which needs to be made clear up front. To do this procedure, one has to be able to reload cartridges. The reason for this is that the baking temperatures used to fuse the Teflon resin coating would just "cook off" intact rounds. This would be hilarious to watch on film or TV, but I wouldn't want to be there in person. Reloading equipment and supplies are very easy to come by, and the reloading process isn't that difficult to do, so this is no real obstacle. In any case, just let me repeat, the slug itself first has to be coated and baked; *then* it can be reloaded into a cartridge.

## Cleaning and Degreasing

Getting the dirt and grease off of the metal surface is the first step to getting an adherent coating of Teflon on the projectile. The removal of all traces of grease and dirt from the surface of the metal is required for two reasons. The first reason is that if a greasy film were left on the surface of the slug, this film would act to protect the surface of the metal from the acid etch used in the next step. This acid etch is very important to both shrink down the size of the commercial slug so that a coating can be applied to it, and to form a rough pitted surface for the coating to find footholds in. It is therefore vitally important that a surface free of all grease and dirt, including fingerprints, be achieved before moving on to the acid-etch step.

The second reason why all traces of grease and dirt must be removed from the surface of the metal is the obvious fact that such contaminants would prevent the adhesion of the Teflon coating to the metal surface of the slug.

In the metal finishing industry, cleaning and degreasing of a metal surface is usually done in a hot vat of what is basically lye solution with soap added. This is generally followed with a solvent wash to cleanse the oil, grease and dirt which escaped removal in the hot soak. Substantially the same procedure will be followed here, with the substitution of hot water soaped up with dishwashing liquid for the industrial soak cleaner. This substitution works just



fine for this purpose. Some elbow grease must be used to make up for the lower strength cleaner.

To clean the slugs, put them into the kitchen sink. Fill the sink with hot water, along with a generous portion of dishwashing liquid. Allow them to soak until the water cools down enough to put your hands in it. Now, while wearing surgical gloves, scrub each slug with a toothbrush. Then toss the cleaned slug into the adjoining sink filled with clean, hot water. This rinse is important to remove the soap film off the bullet. When all the projectiles have been cleaned, drain away the rinse water.

Next, the bullets should be cleaned with solvent. Rubbing alcohol is probably the best choice for solvent because it's not so hard on the skin. Always wear latex surgical gloves for the procedure. Wet the slugs with solvent, then with a clean, solvent-soaked rag. Rub down the surface of the bullet, and place it aside to dry. You shouldn't be noticing much dirt showing up on your cleaning rag. If you do, use of a stronger solvent, such as acetone, may be required. Mineral spirits should be avoided, as a lot of the hardware store mineral spirits contain only contaminants. In any case, the slugs should be solvent cleaned until they don't leave a blemish on the scrubbing rag.

## The Acid Etch

As was stated earlier, the acid etch of the projectile serves two purposes: to shrink the diameter of commercial slugs so that a Teflon coating may be applied and still retain the original caliber, and to pit the surface of the metal so that the Teflon coating will find footholds in the metal surface in which to "grab" onto the surface and form an adherent coating. Teflon won't bond to a smooth surface, so shop-produced steel bullets need the acid etch just as much as the commercial slugs. For this reason, it makes no sense to "undersize" them a little bit while cutting them with the thought that after a coat or two of Teflon they will be puffed up to the proper caliber. They are better when cut at the correct caliber so that a proper etch of the metal can be done to shrink the bullet diameter prior to application of Teflon.

A further word should be said about home-cut steel slugs. This caution concerns changing the shape of the projectile from the round which the weapon usually chambers. A more streamlined bullet shape is useful when penetrating armor. However, when experimenting with sleeker slugs, make sure that the new shape chambers properly in your weapon, and doesn't otherwise mess up the loading, firing, and reloading mechanism. Once a good performer is found, stick with it. Many lathes are programmable, and can turn out identical slugs, one after another.

One simple piece of equipment is needed for the etch step — a micrometer. This simple and inexpensive measuring device is absolutely crucial to following the progress of your etch. If one is turning out



steel slugs on a lathe, it's also required in that process to check the caliber of the projectiles as they are being produced. The Edmund Scientific catalog offers two micrometers, both of which are ideally suited to the purpose. The English system micrometer sells for about $20, while the metric system micrometer goes for about $60. This latter micrometer is a good deal more accurate and precise than the $20 model, but requires that the reader be able to convert from metric to English units, as this work will use that system of measurement.

The chemicals used in the acid etch are found in most any hardware store. To etch steel slugs, hydrochloric (muriatic) acid is used. This material is generally sold in gallon jugs, and the manufacturer will often list the strength of the acid on the label in terms of degrees balme. At least 10% HCl is needed to get a good etch on steel, so for your convenience the following conversion between degrees balme and % HCl is given:

6.6 degrees balme = 10% HCl
10 degrees balme = 15% HCl
13 degrees balme = 20% HCl
16 degrees balme = 25% HCl
19 degrees balme = 30% HCl
22 degrees balme = 35% HCl

The higher quality steels are more resistant to the acid etch than is mild steel. To get a reasonably fast etch on these high strength alloys, one has the choice of using a more concentrated acid, or heating the acid bath, or both.

Copper-jacketed commercial slugs don't etch very well in hydrochloric acid. The etch is exceedingly slow. It can take several days for 15% HCl to etch down a mil or two through copper. Obviously, this won't do. The preferred etchant for copper and its alloys (such as brass) is nitric acid. Full strength 70% nitric acid cut in half with water will zip through copper at the rate of one mil every couple of minutes at room temperature. Higher temperatures will result in considerably faster rates of etch.

It is the goal of this book to avoid the use of chemicals that can't be bought off the shelf at the hardware store, so I did some experimenting with substitutes for nitric acid. As a result, I came up with two combinations that work pretty much as well as nitric acid. Combination number one is ammonium nitrate fertilizer dissolved in hydrochloric acid. Combination number two is a product called Rigo's Best Stump Remover, which contains potassium nitrate, dissolved in hydrochloric acid. Both of these combinations produce nitric acid in solution, and result in a good etch when heated.

To etch the projectiles, don surgical gloves, and then place the slugs on their base (pointed end of bullet up) in a glass baking dish. Use only the flat section of the bottom of the dish, as it will not do for them to fall over while being etched. They should also be spaced no closer than ¼-inch apart. There is a reason for this. The section of the bullet in contact



with the glass dish won't etch as fast as that section which is in free contact with the etching solution. To maintain the proper round shape of the slugs, then, they must be placed base down and not in contact with each other. The surgical gloves are needed to prevent getting greasy fingerprints on the bullets which would interfere with the etch.

Now to etch steel projectiles, pour into the baking dish hydrochloric acid of at least 10% strength for mild steel, and at least 20% strength for higher-quality alloys. The bullets should be completely immersed in the etch solution. Immediate and fairly vigorous fizzing should be noticed within a few seconds of immersion. This fizzing is an indicator of the rate of etch as the steel dissolves, as iron chloride and hydrogen are produced as a byproduct. With hardened steels, heating of the etch solution up to the neighborhood of 140° F or so is likely to be required to get a reasonably fast etch rate.

Every few minutes, remove a randomly selected slug, rinse it off in clean water, then measure its diameter with the micrometer to monitor the rate of etch on them. With these steel projectiles, an etch of at least 2 mils (2 thousandths of an inch) below the proper caliber of the round is required. This will allow the Teflon coating 1 mil thick to be applied to the slug. On a steel projectile, this is enough to protect the barrel of the gun from damage, and also aid in the penetration of the target. A steel bullet can defeat armor simply on the basis of its hardness, so a thick coating of Teflon "grease" isn't required to ease its way through.

When the slugs have been etched to the desired degree, remove them from the acid bath, and rinse them with plenty of fresh water. Then rinse them in water containing some bicarbonate of soda to remove any acid remaining in the pits which would lead to rapid rusting of the metal, followed by another clean water rinse. If they are immediately going to be coated with Teflon, dry them thoroughly as quickly as possible to prevent rusting. If some time will pass before they are coated, then they should be sprayed down with WD-40 to prevent rust.

To etch the commercial copper-jacketed rounds, nitric acid should be used. If this material is easily available to you, just cut the full-strength acid in half with water. Then arrange the slugs base down in a glass baking dish, and pour in the acid until they are completely submerged. Surgical gloves and eye protection should be used when handling nitric acid, as it is considerably more dangerous than hydrochloric acid. An immediate and vigorous fizzing will take place on the surface of the copper jacket as it dissolves. The acid will turn blue due to the presence of dissolved copper. As in the previous example, remove randomly selected slugs at about one minute intervals for diameter (caliber) measurements. Be aware that nitric acid etches copper much faster than hydrochloric acid etches steel. In this case, an etch that reduces the diameter at least six mils is required. The greater etch is



needed in this case because commercial bullets need a thicker coating of Teflon than a steel slug, as these softer rounds need a good greasing to slide through layers of Kevlar. As the rounds make contact with the target, the Teflon will get rubbed off as it passes through, and so a fair thickness is needed to hold up through the passage.

A second reason why a deeper etch is needed on copper is that it tends to pit a lot less than steel does. To get a sufficiently rough surface for bonding of the Teflon coat, a more aggressive etch is need than would be used on steel.

When the rounds have etched at least six mils, which will allow a coating of Teflon 3 mils thick, they can be removed from the acid etch. They can then be thoroughly rinsed with water, and set aside to dry. Copper won't rust, so no WD-40 should be applied to them whether or not they are going to be immediately coated with Teflon.

Most of us don't have easy access to nitric acid, and it is the aim of this book to keep chemical suppliers out of the loop. So, I worked out two hardware store alternatives to nitric acid. Obtain either Rigo's Best Stump Remover or ammonium nitrate fertilizer of at least 20-0-0 strength. Read the label to make sure this nitrogen fertilizer isn't filled with urea rather than ammonium nitrate.

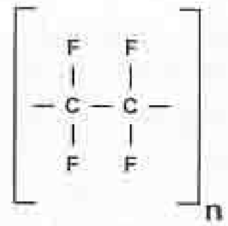
To make a nitric acid mixture using these materials, first determine what volume of liquid will be required to immerse the projectiles fully. Then, in a beaker, measuring cup, or other suitable glass container, add ¼ to ⅓ that volume of either the fertilizer or stump remover. Now to that beaker, pour in hydrochloric acid until the required volume of liquid is reached. The hydrochloric acid must be at least 20% strength, or an unworkably weak nitric acid solution will be produced. Then warm up the solution in the beaker and stir it around until the stump remover or fertilizer has dissolved.

This solution can now be poured onto the slugs in the glass dish. My tests using 20% hydrochloric acid showed that the mixed acid solution requires heating to about 140° F or so to get a good rate of etch on copper. Stronger hydrochloric acid will likely not need as much heating. In any case, the etch using this mixed acid is done just like the previous example using pure nitric acid. Bullets are taken out of solution every minute or so, and their diameter checked with the micrometer. When they have etched down at least six mils, the bullets can be removed from the acid bath, and then thoroughly rinsed and dried prior to coating with Teflon.

## The Resin

Teflon is DuPont's brand name for what is generically called PTFE or polytetrafluoroethylene. The patent has long since expired on this substance, so a variety of other manufacturers now also make this material under different brand names. Teflon is a polymer with the following structure:





$n \geq 20{,}000$

The tetrafluoroethane unit shown above is linked together in chains 20,000 or more units long. In its pure form, the Teflon polymer is white, translucent or opaque, depending upon how thick it is. Many manufacturers will add pigments to the polymer, the most prevalent colorings being grey or black. The coloring doesn't affect the properties or performance of the coating.

Teflon resin suitable for coating metal is generally sold as emulsion of the Teflon polymer. The Teflon in this mixture floats around as small globules, which tend to settle to the bottom of the container over time. As a result, Teflon emulsions should always be stirred up prior to use. Violent mixing techniques must be avoided as this can cause irreversible coagulation of the small (size .05 to .5 microns) globules of Teflon resin in the emulsion. If one has a gallon jug of Teflon emulsion, the best way to get it stirred up prior to use is to tip the jug upside down, then right side up, a number of times over a two minute period. A five-gallon pail is best agitated by rolling it around on the floor for a few minutes.

The Teflon-loaded paints sold under the trade names of Xylan and Everlube can be stirred or otherwise agitated, with a good deal more gusto than the pure Teflon coatings supplied by DuPont. In all cases, it is essential that those little globules of Teflon in the coating get mixed up from the bottom of the container before applying the material to your slugs.

Not everything sold on the market as a "Teflon coating" produces a film of any value. The most important factor in determining a quality Teflon coating is the percent of Teflon resin actually contained in the emulsion. One product, called RO-59, contains so little Teflon that the coating is invisible, as are its benefits. When picking up a Teflon emulsion containing an unknown amount of Teflon resin, one can get a close estimate of the amount of Teflon resin it contains by weighing it to determine its specific gravity, i.e., how many grams a ml of emulsion weighs. A 100 ml volumetric flask, and an accurate scale, result in a very close approximation of the specific gravity. The following table correlates specific gravity to percent of solids and grams of solids per milliliter.

| % solids | sp. gr. | grams solid/ml |
|---|---|---|
| 35 | 1.24 | .436 |
| 40 | 1.29 | .515 |
| 45 | 1.34 | .601 |
| 50 | 1.38 | .693 |
| 60 | 1.50 | .900 |



A good Teflon coating containing Teflon resin in the concentrations shown above will cost around $100 per gallon.

Teflon resin emulsions are sold in a variety of formulations. The system sold by DuPont consists of a primer and a top coat. This product produces a coating of pure Teflon, but it suffers from several problems. One severe problem with this system is that the primer has a very short shelf life. At 80° F, the shelf life is two weeks, while at 60° F, the shelf life is four weeks. At 40° F, it will last about 12 months. The temperature sensitivity of this primer also expresses itself in permanent coagulation of the Teflon resin it contains. Allowing its temperature to exceed 80° F, or to reach freezing, will ruin it.

As a result of the shelf life problem, the DuPont Teflon primer is sold in two forms. The product they call 851-204 is a premixed primer acid accelerator formulation that exhibits all of the properties described above. DuPont won't ship this material outside the country because of its short life.

The alternative formulation of the primer, called 850-3XX, and the acid accelerator, called VM-7799, are packaged separately. They can then be mixed together just prior to use, 100 parts of 850-3XX to 35 parts of volume VM-7799. The two components must be gently agitated prior to mixing, then the required amount of acid accelerator is slowly added with gentle stirring to the 850-3XX. This produces a very acidic mixture which must be handled with respect. The pre-mixed primer is also quite acidic. Once mixed, this primer has the same temperature dependent shelf life as 851-204.

The primer contains a healthy amount of Teflon, but for best results it should be followed with the application of one of the DuPont Teflon top coats. They are sold under the following designations: 851-214, 851-221, 851-224, and 851-255. The first product is called a "low build" coating. Each dip will give a coating of about one mil thickness, and by putting on successive coats, a total coating thickness of about three mils can be built up. The last three products are called "high build" coatings. They give a coating thickness of about 1½ mils per dip, and the coating can be built up to about eight mils. Shelf life of these products is about 18 months at room temperature. They too must be gently agitated prior to use, and not allowed to freeze.

DuPont makes a series of other Teflon coatings similar to Silverstone. These are Teflon coatings reinforced with ceramic particles to give a hard, non-stick surface. These systems are considerably more difficult to apply correctly, as they are three-coat products with the absolute and relative thicknesses of the primer, mid-coat and top coat being critical to its adhesion and performance. One is best served to stay away from these products, as they make the process needlessly complex, and they put time restraints upon the procedure. The old axiom of "Keep it simple, stupid!" is best followed in this situation.

An attractive alternative to the pure Teflon coating offered by DuPont is the Teflon-loaded paint



sold by the Whitford Co. under the trade name of Xylan. This material has several advantages over the pure Teflon coating from DuPont. Most importantly, it is much easier to apply than the DuPont product, and its adhesion to the metal surface is quite good. There are no primers involved with Xylan; rather it is a one-component coating. The paintlike binder in the Xylan acts to stick the coating to the metal surface, while the embedded Teflon (they have to use the generic name PTFE) in the coating gives it a slickness similar to Teflon. For the purposes used here, this coating is probably superior to the DuPont material. The film is tougher than pure Teflon, while its coefficient of friction is just as low. Whitford makes a series of related coatings containing PTFE. The most suitable for the purpose is Xylan 1006, as it contains the most PTFE: about 40%.

The E/M Corporation also produces a line of PTFE-loaded paints under the trade name of Everlube. They are quite similar to the Xylan coatings produced by Whitford. The most suitable product offered is Everlube 6107. The reader should note that the Everlube products aren't meant to be built up to the thicknesses that DuPont's Teflon, or Xylan are. This doesn't mean that Everlube can't be built up to the extent where it would be useful. I just don't know, not having had the firsthand experience with their products as I have had with Teflon and Xylan.

## Projectile Coating

As was alluded to earlier, the basic procedure for applying a Teflon coating to metal is to dip, bake and then fuse the coating. The thickness of coating which results from one pass through this cycle will vary with the individual product being used. A coating thickness of from ½ to 1½ mil (½ to 1½ thousandths of an inch) is typical from the Teflon emulsions. The reason why the thickness of the deposit will vary from one product to another is mainly the viscosity of the resin emulsion. The "thicker" the emulsion's consistency is, the thicker the layer of resin which will cling to the metal. Since cooling down the emulsion will also cause it to become "thicker," the same product can give varying thicknesses of coating depending upon temperature. Another factor which influences the thickness of coating applied is the percentage of solids in the emulsion. As you could guess, the higher solids products will give a thicker coating.

To get a build-up of Teflon coating three mils thick from an emulsion that produces a coating one mil thick on a single dip-and-bake cycle, one simply runs the slug through the dip-and-bake repeatedly until the desired thickness of coating is achieved. This is far superior to allowing the emulsion to evaporate down to "thicken it up" or adding water soluble thickeners known to the paint industry, such as Acrysol GS or Carbopol 934. Such "thickening" will cause the emulsion to form a coating which exceeds



the critical thickness. Critical thickness is defined as the maximum thickness of coating which can be formed in a single pass through the dip-and-bake cycle without the formation of cracks in the coating when it is dried. Small cracks can be tolerated because they will melt shut when the sintering or fusing temperature is reached during the baking process, but large cracks will produce a lousy, non-aerodynamic coating. The product will come formulated to produce a coating below the critical thickness, and it's best not to mess with it to try to get thicker coatings of Teflon per pass through the dip-and-bake cycle.

The first thing which must be done then, is to run a sample bullet through the dip-and-bake cycle to measure the thickness of coating produced on your slug. In general, the manufacturer's claim for their product can be taken as pretty accurate, but they should be checked. Also, it's quite possible that one may be using an emulsion that produces a coating of unknown thickness. This will be the case if one goes "jug in hand" to a plant which is in the business of Teflon-coating articles, and buys a jug of resin emulsion from them (There is much more on low-profile ways to come by Teflon emulsions in the next section of this book.) There is a further advantage to first running one sample projectile through the coating process, in that it gives you practice in the procedure, and allows you to work out the bugs in your technique before moving on to a more assembly line production.

The dipping procedure will differ somewhat, depending upon whether one has steel slugs or the commercial, copper-jacketed items. With the steel slugs, one must first remove the coating of WD-40 that was applied after the acid etch to prevent the slugs from rusting during storage. To remove the WD-40, first soak the projectile in some acetone or toluene (obtained off the shelf at the hardware store paint section) to remove the vast majority of the coating, then transfer the slug to some fresh acetone or toluene to remove the rest. Then, while wearing surgical gloves to prevent smudging the metal, remove the bullet from the solvent and wipe it off with some clean paper toweling. This two-pot solvent dip won't help to make this single slug any cleaner, but once one is running a fair number of bullets through this process it will help a great deal, because most all of the WD-40 will be left in the first solvent pot, allowing a final rinse in clean solvent. One can't get the projectile any cleaner than the solvent used to rinse it.

## Application of Xylan Coating

Now it's time to dip the item into the Teflon emulsion. With a steel slug, attach a magnet to the base of the bullet. Be sure that all the solvent has evaporated off the metal surface, then dip the slug nosefirst into the emulsion until it is almost all the way submerged up to the base. Then pull it out of the emulsion, and let the excess drip back into the



emulsion. Keep the bullet nose facing downward for this drip, so that gravity assures that an even coating sticks to the sides of the projectile.

With a commercial copper slug, a magnet can't be used because neither the copper jacket nor the lead core will cling to a magnet. In this case, attach a clamp to the base of the slug, and dip it nosefirst into the emulsion until it is immersed just about up to the clamp. Then pull it out of the Teflon, and let it drip off nose downward.

The next thing which should be done is to let some of the solvents evaporate off the coating. This can be done by just letting it dangle in the air for about ten minutes. One can speed up this process by using infrared heat lamps or blowing hot air from, for example, a hair dryer. When one scales up production and has a number of slugs dangling next to each other, one must be careful that any blown hot air doesn't cause them to bang into each other and mess up the coating. Ditto for magnets bumping into each other and sticking a couple of slugs together.

At the conclusion of this preliminary solvent evaporation, the Teflon coating has a gooey, tacky consistency. It will not airdry to a solid film. There are two reasons for this. The first reason is that Xylan contains some solvents that aren't easily evaporated off at room temperature. The second reason why it won't set at room temperature is that the resin matrix that contains the Teflon emulsion is a thermosetting resin. It requires a bake to make it cure.

Preheat the oven to 450° F. Now hang the slug, still attached to its clamp or magnet, from the oven rack with some wire. Be careful not to let the coating touch anything. Bake for 15 minutes at 450° F. This sets the Xylan into a dry, very slick coating.

After the bake process is over, remove the slug from the oven, and allow it to cool back down to room temperature. Once cooled, the thickness of the coating can be measured by using the micrometer to see how much the diameter of the projectile has increased. It's very important that this measurement be done at room temperature, as metal expands with heat.

This one coat of Xylan will be enough for a steel projectile, as the main benefit of the coating on a steel slug is to protect the gun barrel from damage. A commercial copper-jacketed bullet will need more than one coat to aid its penetration. At least three mils build-up are required. To get this build, a somewhat modified procedure must be followed. Additional coats of Xylan won't stick to an undercoat of Xylan if it has been baked to 450° F. To pile one coat over an existing coat of Xylan, the bake must be done at 300° F for 15 minutes. Only with the final coat that ultimately reaches the desired thickness of Teflon is the baking done at 450° F. In the case of these multiple coats of Xylan, the final bake at 450° F should be done for a more extended time, 20-25 minutes. Other than this variation in the temperature of bake, the procedure for applying coat over coat of Xylan is the same. One just dips the slug



into the emulsion. Then the excess is allowed to drip off nose downward. This is followed by about ten minutes of air drying, followed by a bake.

## Application of DuPont Teflon

Getting a good, adherent coating of pure Teflon is considerably more difficult than applying Xylan. The use of a DuPont acid primer is mandatory to get good adhesion to the metal surface. Much higher baking temperatures are also needed with the pure Teflon coating. Further, while the primer is loaded with Teflon resin emulsion, it doesn't produce a really nice, slick coating. The primer, once applied and cured, should be overlaid with a DuPont Teflon top-coat to get a properly Teflon-coated bullet.

The metal preparation for applying Teflon is identical to that for Xylan, and the overall procedure is also quite similar. One starts with a steel slug suspended with a magnet attached to its base, or a commercial, copper-jacketed bullet clamped at its base. It is next dipped into the primer, either the 851-204 pre-mixed primer or the 850-3XX two-package primer to which the 35 parts by volume of VM-7799 acid accelerator has been added to 100 parts of 850-3XX. The primer must be gently agitated just prior to use to get the Teflon resin evenly dispersed in the primer. The container holding the primer must be acid-resistant to keep it from being eaten through or dissolving metal plating on the container. This metal contamination of the primer will ruin it.

A glass measuring cup is quite suitable, as is a cut-out bottom of a plastic milk jug.

With the slug properly suspended, dip it into the primer to the same depth as is the case with Xylan. Similarly, then, withdraw it and allow it to drip off nosefirst back into the pot of primer. This is followed by an airdrying of the coating. Some heat is quite helpful for this process, but drying temperatures in excess of 180° F must be avoided because this would force the water and other volatile ingredients out of the coating too fast and result in bubbles forming in the coating. At the end of the airdry, the coating is solid, and can be touched gently without ruining the coating. Greasy fingerprints will prevent the top coats from sticking to the primer, so surgical gloves should be worn if the Teflon is going to be touched.

The airdry is followed by an ovenbake to cure the coating and to drive out wetters and other more difficult to evaporate ingredients. The oven is preheated to 450° F, as is the case with Xylan. Similarly, hang the slug from a wire hook attached to the oven rack and bake for 20 minutes.

It is possible to use just this primer coating on a steel projectile. One should measure the thickness of coating achieved by the dip in primer the same way as with Xylan. It will be around one mil. If only this single coat is going to be applied, the Teflon must next be sintered or fused. This is a higher temperature bake which melts the Teflon resin contained in the coating and produces a much stronger, more adherent film that also displays considerably better



non-friction properties. A temperature of 675° to 750° F is used for this fusion step. The oven at the plant where I work has no problem reaching these temperatures, but the dial on my stove at home doesn't go that high.

There is a way around this problem. The broiler of a home oven does attain this temperature range. First, one must determine at what distance from the broiler heating element the desired temperature is reached. For this, one needs a reliable thermometer. Thermometers which measure this temperature range are easily available from many sources. A few are listed for your convenience:

VWR Scientific, 1-800-932-5000
Cole-Parmer Instrument, 1-800-323-4340
Omega Engineering, 1-800-826-6342

Next, take this thermometer, and coat the bulb or other temperature-sensing area of the temperature probe with a coat of Teflon. This coating is required because a broiler heating element primarily heats on the basis of radiated heat, rather than hot air surrounding the object. One wants the temperature probe to have the same radiation absorbing qualities as the slugs, so it should be coated.

Now, after the Teflon coat on the thermometer bulb area has dried and been baked, put it on a baking pan and stick it under the broiler. Find the distance from the broiler element(s) where the desired temperature is reached. Then put your

Teflon-coated slug on the baking pan, base down, and put it under the broiler at that distance from the heating element which gives the desired temperature. Heat for a period of 5 to 8 minutes. It should be evident that the coating has fused, or melted. Any small cracks that may have been in the coating should be melted shut. A small amount of soot may also appear on the surface from the presence of some residual wetter.

Normally, one doesn't just want to be satisfied with the primer coating. For a commercial copper-jacketed slug, a build-up of at least 3 mils is necessary. The performance of steel projectiles is also improved by following the primer with the application of a top coat. To get the top coat to stick to the primer, the sintering bake on 675° to 750° F must be delayed until the desired build-up is achieved. So, following the cure bake at 450° F, one allows the bullet to cool. Then it is dipped into one of the DuPont top coats mentioned earlier: 851-214, 851-221, 851-224 and 851-255. The top-coat Teflon emulsion must be gently agitated just prior to use. This substance isn't acidic, so one doesn't have to worry about the kind of container being used to hold it, or about getting it onto the skin. The main health concern with this material concerns smoking. If you get Teflon resin smeared onto a cigarette, it will make you sick. Be warned.

Following the dipping into the top-coat, allow the bullet to drip off, then airdry it. Airdrying at 120° to



140° F will help to prevent cracking or bubbling of the film during the oven bake.

Next, pre-heat the oven to 600° F. If your oven only goes up to 550° F, just add 5 to 10 minutes additional bake time. Now put the slug into the oven, hanging from a wire hook attached to the magnet, or clamp it to the oven rack. Bake at 600° F for 10 to 15 minutes, or 550° F for 15 to 20 or 25 minutes.

After the bake, the projectile can be removed from the oven and allowed to cool. The high-build products will give a thicker coating than 851-221, and are the only products to use to build up thick layers of Teflon. Additional coating thickness is achieved by allowing the bullet to cool, and dipping it again into the top coat, followed by drip, airdry, and bake.

When the desired build-up has been reached, the sintering or fusing bake should be done as described earlier. Just remove the slug from the magnet or clamp after the cure bake at 600° F, and put it base-down on a baking pan and broil (or bake,if you have the proper oven) at 750° F for 18 to 25 minutes. The longer time and higher temperature are due to the thickness of the coating, and the nature of the top coat versus the primer. Some soot may be noticed on the surface of the Teflon from the destruction of residual wetter. This can be wiped off with a solvent-soaked rag.

When the desired thickness of coating has been reached, one is ready to reload the slug into a cartridge and do some test firing. The most important property to test for is good adhesion to the metal substrate. Fire a slug into a tank of water, and recover the slug for examination. The coating should look pretty good, with rifling marks on the side of the slug.

Next, a more demanding adhesion test can be done by shooting a slug into a bunch of packed cotton wadding. The Teflon in this case should show some wear, but should not be flaked or peeled off in a wholesale manner. One can next move up to phone books, stacks of newspapers, etc.

Poor adhesion can be caused by a variety of factors:

1. Insufficient roughness and pitting of the metal surface. This is quite unlikely in the case of steel projectiles, as the acid etch will generally produce a surface as rough and pitted as a corn cob. Copper gets a finer-grained etch in general, and additional roughening by means of sand or bead-blasting, or other abrasive methods could be called for, such as coarse sandpaper.
2. A dirty, greasy metal surface. Good metal cleaning and the wearing of surgical gloves will prevent this source of adhesion problems.
3. Incomplete fusion of the Teflon coating. Increasing the time of the fusion bake, and making sure that the proper temperature is being reached, will cure this.

Once one has worked out any bugs in the coating process, it's an easy matter to dip and bake fairly large numbers of projectiles at a time.



# Part Three: Low Profile Resin Procurement

*"The days are long gone when we show up to serve a warrant wearing a suit and a tie."* — A federal agent testifying before the Congressional Waco Committee

All of the information contained in this book up to this point is of little value if one isn't easily able to obtain Teflon resin emulsions suitable for application to metal surfaces. Luckily, this isn't the case. Teflon resin emulsion is widely available from quite a variety of sources. Further, the possibility that it may be put to nefarious uses isn't even a thought in the minds of those who distribute it. This situation isn't likely to change in the future, barring a massive media campaign against the evils of Teflon.

In a perfect world, Teflon resin emulsion would be sold on hardware store shelves, and available in bottles and aerosol cans. This isn't the case. My True Value hardware-store man laments this situation, as he says that he's been trying to find an aerosol spray Teflon for years to use in his lock department. Some hardware store products contain Teflon in combination with other lubricating ingredients, but none of them produce an adherent coating of Teflon. Given the wide variety of household or shop uses to which

Teflon could be put, this is a clear marketing oversight. No doubt there is some technical difficulty making the packaging of aerosol Teflon inconsistent in its performance. Otherwise, it would be a clear winner. Just think of coating the bottom of your kid's snow saucer or sled runners or toboggan with some Teflon, to get that added speed in the snow. Ditto for skis — snow, water or jet. The list could go on and on. Would a boat cut through the water better with Teflon coating? The number of probable good uses is limited only by the imagination.

Lacking a suitable hardware store product with which to apply a Teflon coating to bullets, how does one obtain Teflon resin emulsion without anyone thinking that a dastardly scheme is somehow being put into motion? There are a couple of ways to come at this problem, and my years of experience in the metal-finishing field tell me that both of them will work with no hassles or suspicion involved.

Plan number one is to show up "jug in hand" at a plant which is in the business of applying Teflon to metal, and talking them into selling you a gallon or so of their resin emulsion. This very low-profile and anonymous procedure has what I would estimate to be a 50-50 chance of success at any particular plant. The small, less bureaucratic business is more likely to be agreeable than the large outfit because people in the smaller plant will be more used to making decisions themselves without passing the buck. The person you talk to when you walk in the door is likely to be able to make the decision of whether or



not to give it to you, or will be at least able to yell into the rest of the office to get your reply. There is one factor which will nag at the back of their heads, and produce some hesitance in selling you some resin. This is the hazardous-waste laws. Most plants which apply Teflon to metal do it as a sideline to the main business, which is plating metal. These guys have been shell-shocked with a real blitz of environmental laws over the past 20 years or so. They are literally afraid to fart for fear of being in violation of some environmental regulation. They may wonder if parting with some of their resin could be considered illegally disposing of hazardous waste. Of course, it's not a violation of any law. First of all, the Teflon isn't hazardous. Secondly, it's not waste, since you are going to be putting it to use. Such clear logic may be of no use at some places. That's the major reason why I estimate the probability of success at any particular plant at about 50-50.

To put this plan into motion, the first step is to get the business-to-business telephone directory. It may be called such things as "industrial purchasing guide," or a similar name, in your area. This phone book should only cover your particular geographic area, and it should have a section of Yellow Pages in which businesses can advertise their products and services. Don't bother with nationwide directories or 800-number directories, as they won't contain the information you want anyway. The library is a sure bet to have this phone book if it's not right at hand in your home.

Now look in this phone book in the Yellow Pages section under "plating." Here you will find nearly all of the metal-plating shops and plants in your area, along with a listing of what processes and services they offer. Just make a list of those who do Teflon.

The next thing to do is to just show up at the front door of one of these plants, "jug in hand." It would be best to avoid the homeless bum look, the escaped-nut look, or anything else which may turn them off on you, or cause them to worry about your safety when handling Teflon resin. Then merely ask at the front desk about obtaining some of their Teflon resin emulsion. They are likely to ask what you want it for. This question is a combination of curiosity and a desire to do whatever job you have planned for it themselves, and thereby making more money. The proper reply to their query is "workshop and home tinkering," along the lines I listed earlier in this chapter, such as experimenting with coating snow-saucer bottoms, skis or even boat hulls. They will be impressed with your ingenious nature and self-motivation. They may even question your ability to use the emulsion, and may quiz you a bit. All the information you need to use Teflon emulsion is in this book. Study it before shopping. One thing they will not do is suspect that you want to coat bullets with it. Be nice, calm and answer any questions they may have without giving the impression of evasiveness.

Once you have made the deal ($100-$200 per gallon is in the reasonable range), it would be best to



pay in cash to maintain the anonymity of the situation. When your jug is filled, cap it securely and be sure to use it all up within the afore-mentioned shelf life. Additional information, such as the brand of emulsion, its percent of solids, etc., may be had by asking for a copy of the Material Safety Data Sheet (MSDS) as you head out the door. By law, they should be giving that to you when they transfer the material, but don't make it a big point, or act like a smarty-pants. You got it from a plant that's in the business of coating metal with Teflon, so you can assume that it's suitable for the purpose. The lone exception to this rule is if the plant is using the multiple-coat type of Teflon (i.e. primer, midcoat and top-coat), or a composite such as SilverStone. If this is the case, you should forget about that particular plant, if that's the only type of Teflon resin they have. Try the next one of the list. You will hit the jackpot at one of them.

If your particular area has no shops which apply Teflon to metal, or if they are so few in number that the "jug in hand" plan comes up with nothing there is an alternative method by which to obtain Teflon (PTFE) emulsion. This is to contact the manufacturer directly and buy some. At the time of this writing in mid-96, there is no problem in doing this. There are no laws regulating the distribution of Teflon resin, nor is there a well-rooted bed of suspicion out among the industry that their product would be put to other than conventional uses.

I have found three manufacturers/distributors for Teflon (PTFE) in the U.S. There may be more, but these three have the sense to advertise. Ordering from all three is pretty much the same — not difficult. They have a product, and they want to sell it.

Let's start with the really big player on the market, DuPont. They sell their Teflon coating through a division called InTech. Their phone number is 1-302-366-8530. When the phone is answered at the other end, just ask for Technical Sales, and they will put your through to a salesman who knows a fair amount about the Teflon products they offer, and their uses. This book will have prepared you well for this meeting. The best plan to follow is to identify yourself with some make-believe shop name like XYZ Plating, Finishing, or Machining, followed by what may or may not be your real name. There are so many shops operating out there that no one can keep track of them all. Some businesses just work out of a garage and do custom finishing work. You can explain how you have a customer who, for example, has a problem with winding of tape or similar sticky stuff on his machinery and thus needs a release coating of Teflon on his metal parts. Alternative end uses similar to the ones mentioned at the beginning of this chapter are equally viable. In any case, the salesman will ask about the end use of the Teflon resin. This is so that he can be sure he is selling you the right product. The DuPont Teflon products mentioned in this book: 851-204 primer followed by the 851- series of top coats are the products designed



for application onto metal. Just sound like you know something, and you'll have no problem. When placing the order they will ask for a P.O. number (purchase order number). This is just a paperwork contrivance designed to help keep one's books in order. Reply with any random four-digit number. Then ask for COD delivery so that you next don't have to go through their credit department to set up an account. That's about all one needs to know to order Teflon.

The easier-to-apply Xylan coating is ordered by directly calling the Whitford Co. At 1-610-296-3200. After talking to Technical Sales and having a similar conversation to the one described earlier for DuPont, Xylan 1006 is yours to order COD.

I haven't given much space here to Everlube Teflon-loaded paints from E/M Corp., but it should be similar to Xylan. Their 6107 coating would be most suitable, although it contains less Teflon than Xylan. To reach these folks, call 1-317-497-6308.