$16.95 U.S.

RELOADING FOR SHOTGUNNERS

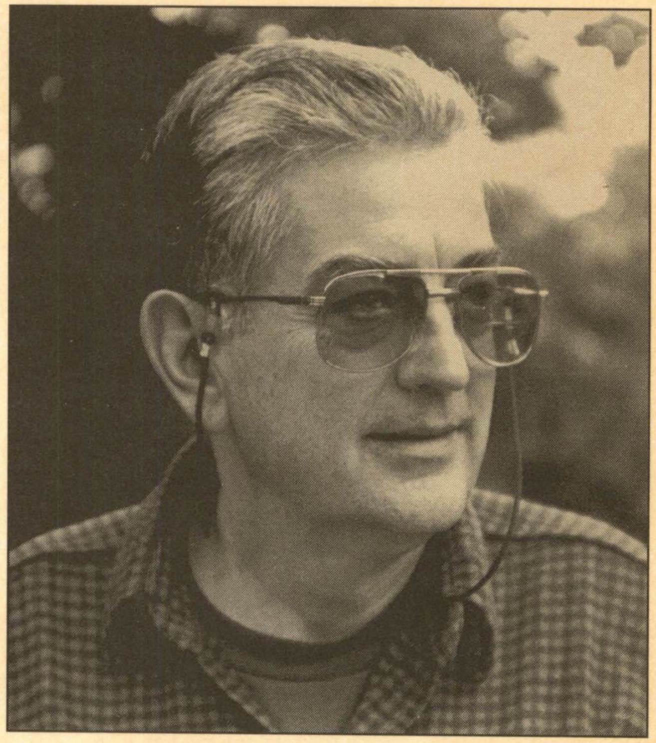
ALL NEW AND EXPANDED 3RD EDITION

■ OVER 2,000 LOADS ORGANIZED BY RECOMMENDED APPLICATION, GAUGE, CASE TYPE AND SHOT CHARGE ■

■ The complete how and why of shotshell reloading for hunters, and competitive shooters.

By Edward A. Matunas

ABOUT THE AUTHOR



Edward A. Matunas has been an active shotgunner, hunter, reloader and ballistician all of his adult life. His first gun, a 12-gauge J.C. Higgins bolt-action model, was given to him by his parents when he was a young teenager. The guns and ammo that were to become the tools of his intense sporting interests were also destined to become a lifetime vocational undertaking.

It started at about age twenty, when Ed took a job and later became senior gunsmith and general manager of one of the East's largest retail/wholesale gun houses in his native Yonkers, New York.

Ed's fondness for the country life soon caused him to move to rural Connecticut, where he was employed by Lyman Gun Sight Co. as Technical Services Manager. During this time, Ed built Lyman's first fully equipped ballistics lab and was responsible for the contents of several of Lyman's Reloading Handbooks, including the industry's first exclusively shotshell reloading handbook. After Lyman, a few years were spent with Ohaus in New Jersey with Ed designing, engineering, and overseeing the production of reloading tools and the machinery and tooling to make them.

Ed missed the "better" hunting and shooting opportunities of Connecticut and so moved back and spent eight years as a national sales manager for Winchester. During this time, he was also editor of numerous Winchester reloading handbooks and was shooting promotion manager for the company. Ed then became a vice president for an international shotshell firm.

Tiring of the corporate life, Ed began writing on a full-time basis (he had already published several books and several hundred magazine articles dealing with the shooting sports and reloading). This self-employment also led to, on a by-demand basis, marketing and manufacturing consulting as well as expert witness efforts in court on cases dealing with ammunition accidents.

Ed has now authored more than 600 magazine articles and columns as well as a dozen books, all dealing with firearms, ammunition, reloading, shooting and hunting. He has also loaded and fired more than a million rounds of ammunition for laboratory testing in conjunction of the development of reloading data. Countless thousands of rounds of factory ammunition have also been fired and tested.

Ed has often stated that he feels super lucky that he has been able to spend a life making a living doing what he enjoys the most. He has used his reloads almost exclusively for his hunting, which has taken him to about a dozen countries on five continents. He has also stated that his greatest pleasure is being able to pass on his knowledge of the shooting sports, ammo and reloading.

ISBN 0-87349-151-3

90000>

EAN

9 780873 491518

RELOADING FOR SHOTGUNNERS

3rd Edition

By
Edward A. Matunas

DBI BOOKS, INC.

STAFF

SENIOR STAFF EDITOR
Harold A. Murtz

PRODUCTION MANAGER
John L. Duoba

EDITORIAL/PRODUCTION ASSOCIATE
Jamie L. Puffpaff

ELECTRONIC PUBLISHING MANAGER
Nancy J. Mellem

ELECTRONIC PUBLISHING ASSOCIATE
Robert M. Fuentes

GRAPHIC DESIGN
Jim Billy

MANAGING EDITOR
Pamela J. Johnson

PUBLISHER
Sheldon L. Factor

ABOUT OUR COVERS

Part of the enjoyment of the shooting sports involves reloading ammunition, and for the avid shotgunner it's the only way to keep costs down, shooting time up, and tailor loads to his special needs and desires. Our covers represent two of the oldest names in the ammunition business—Hornady and Hodgdon.

Center stage is the latest in shotshell reloading technology from Hornady—the Apex Auto press. It comes complete with all automatic accessories, factory installed and adjusted. The reloader just inserts a shell and wad, and pulls the handle. Everything else is done automatically.

An easy-access shell plate allows removal of a shell from any station at any time for inspection. If there's a problem with the shell, it can be left out and the reloading process continued; the press will not drop powder or shot when a shell is missing from that station.

The Apex Auto utilizes a unique set of linkage arms that create tremendous leverage and make the press very easy to operate. Since all operations (depriming, sizing, primer seating, wad insertion and crimping) are completed at the bottom of the stroke where the leverage is greatest, the reloader experiences less fatigue when loading large numbers of shells.

This press features a full-length collet size die to fully resize the brass head; an automatic primer feed with a shell detector to prevent a primer from being dropped when no shell is present; an auto charging system with detectors which prevent powder and shot from being dropped if a shell is not present; a dual-function crimp die to crimp and taper each shell at the same time for factory-like crimps; and an automatic shell plate index with manual override to switch the press to non-progressive operation.

All of these features, and more, add up to a shotshell press that can't be beat for shotgunners who do a lot of shooting...and that's the other fun part of our hobby.

A name that shooters world wide are familiar with, Hodgdon, has powders for nearly every shotgunning need.

Their newest powder,Clays, was developed for 12-gauge clay target shooters. It's extra-clean burning and perfect for trap, Skeet and Sporting Clays shooters.

International Clays, inspired by the new technology developed when the challenging Sporting Clays game was designed, is said to be the answer for shooters who want reduced recoil in 12- and 20-gauge target loads.

Universal Clays is an extremely small grain extruded flake powder that provides consistent charge weights through the powder measure. It loads nearly all of the straight-wall pistol cartridges, as well as 12-gauge 1¼-ounce through 28-gauge ¾-ounce target loads.

Hodgdon HS6 is an excellent spherical propellant for many handgun loads, but it's also a dual-purpose powder that many shotgunners prefer for 12- and 20-gauge loads for upland game, rabbit and squirrel.

An excellent powder for turkey and goose loads is HS7, a spherical propellant that's excellent for heavy field loads. HS7 has also received acclaim for its adaptability in steel shot reloading.

H110 is a dual-purpose powder that's extremely useful for high pressure handgun loads, but is also especially recommended for 410-bore shot loads.

H4227, an extruded powder, is useful for some 20-gauge and 410-bore loads, and has proven popular for many rifle and handgun applications.

All of these excellent Hodgdon powders are available in 1-pound cans, 5-pound caddies and 8-pound kegs.

Photo by John Hanusin.

The views and opinions contained herein are those of the author. The editor and publisher disclaim all responsibility for the accuracy or correctness of the author's views.

Since the author, editor and publisher have no control over components, assembly of the ammunition, arms it is to be fired in, the degree of knowledge involved or how the resulting ammunition may be used, no responsibility, either implied or expressed, is assumed for the use of any of the shotshell loading data in this book.

Arms and Armour Press, London, G.B., exclusive licensees and distributor in Britain and Europe; New Zealand; Nigeria, South Africa and Zimbabwe; India and Pakistan. Lothian Books, Port Melbourne, Aust., exclusive distributors in Australia.

ISBN 0-87349-151-3

Library of Contress Catalog #81-65119

FOREWORD

THIS, THE THIRD edition of *Reloading For Shotgunners,* has taken a different approach to the reloading of shotshells. RFS, as it is called in-house, has now taken the same textbook approach as its companion, *Metallic Cartridge Reloading,* 2nd Edition. This maturity is the result of your support for the first two issues of RFS and your input as to what you felt was needed. It is also the result of giving very careful consideration to the ins and outs of shotshell reloading.

Some reloaders assemble shotshells with an almost cavalier attitude. If the components of a specific set of loading data cannot be matched exactly, then a misinformed reloader might substitute a case, primer or wad. And too often, some forget that powder and shot bushings are not absolutes which throw some specified charge weight as shown in manufacturer's literature. The exact components shown in any loading recipe must always be used. And both propellant and shot charge weights must always be verified with an accurate avoirdupois scale. Anything less may result in very serious grief.

Simply opening a data book and selecting a load does not qualify one to reload shotshells. Take the time to read all of the material in this book before making any attempt to assemble your own ammo. The information contained herein is essential, though admittedly it is not possible for us to foresee every problem or question. Also, always follow all the warnings and cautions of your component manufacturer. This is critical, especially with propellants. Finally, double-check every load you wish to assemble with the data supplied by the propellant manufacturers.

Shotshell reloading is not a difficult undertaking, if all instructions are followed. For the most part, shotshell loading tools are self-contained units, and the need for accessories is very limited, except for the mentioned powder and shot scale. The other essentials are a good source of loading data and an adequate record-keeping system.

It is hoped that this book will supply much of the needed information for both the novice and experienced reloader. But, it is important to remember that no single source can answer every question. Whenever doubt exists, contact the manufacturer of the component in question. Never, I repeat never, continue to reload when even the slightest doubt is present. If your ammo does not look and perform as well as factory shells, then there is a problem; the responsible reloader will not use such ammo and will refrain from further assembly of any ammo until the problem is corrected.

Shotshell reloading can be a safe and rewarding hobby. It can allow the shooter to save up to 50 percent, or more, of the cost of ammo. This, in turn, can allow the reloader to shoot a great deal more. And more shooting is what makes for a proficient shotgunner and enjoyable hunting and target shooting. Follow the rules and you will gain a lot of satisfaction from shotshell reloading. Ignore the rules and a serious accident might serve to point out that the rules were not there just to make things difficult.

There is a new format for the data in this issue of RFS. We have endeavored to make loads easy to find based on the specific applications intended. We hope you find the new format convenient.

Feel free to send along your comments on this third edition of RFS. While personal answers are seldom possible, we do appreciate hearing your views on our efforts. If you would like to gamble on the chance of a personal reply, enclose a stamped, self-addressed envelope with your comments. Send your comments to RFS, DBI Books Inc., 4092 Commercial Ave., Northbrook, Illinois 60062.

Ed Matunas

WARNING: *Never use lead shot with steel shot data and never use steel shot with lead shot data. Lead and steel pellets have drastically different ballistic properties and to mistakenly use one for the other can cause serious property damage and/or personal injury—even death.*

CONTENTS

CONTENTS

CHAPTER 1

Why Reload Shotshells?

THERE ARE MANY reasons to reload shotshells. Economy, of course, heads the incentive list. A reloader can expect to save approximately 50 percent of the cost of factory shells. Customizing ammo to reduce velocity levels for lower recoil or to adjust shot size and charge weights for specific shooting purposes and performance are very important reasons to reload your own shotshell ammunition. And, then, there is just the enjoyment and satisfaction one derives from the reloading process, and the pride in taking game or breaking clays with ammo you have assembled.

Economy

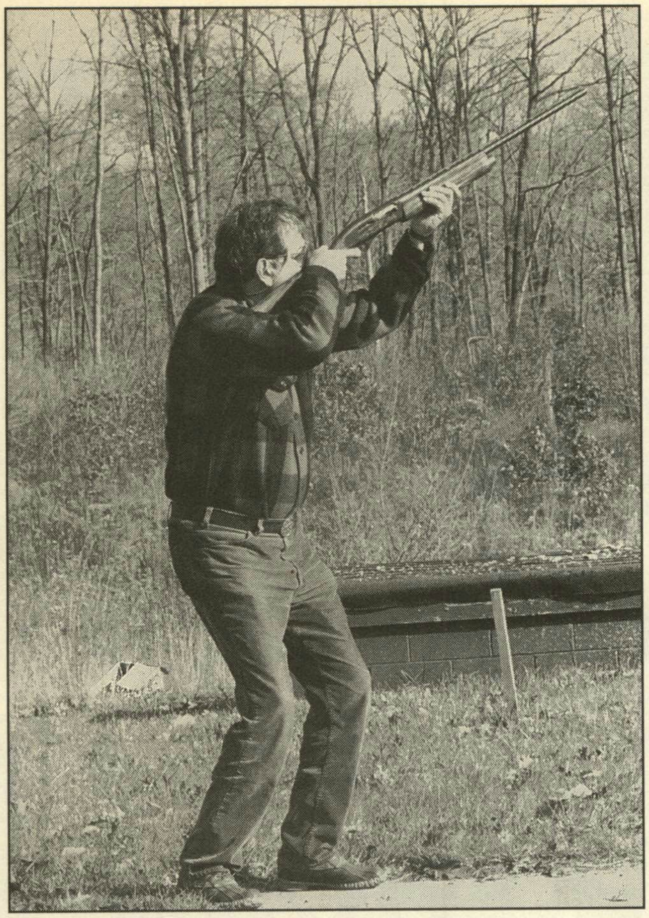
Most shooters first consider reloading as a way to save money. There is no doubt that most shotshell reloads can be assembled for half, or less, of the cost of factory ammunition. The exact amount saved will, of course, vary with the specific load assembled, the number of shells reloaded, the retail store of your component purchases and how many firings can be had from the case being loaded.

The components listed in a given load will more or less fix the actual cost to reload. But some variation can occur. For example, $1^1/_8$ ounces of shot will cost a given amount, variable by the current market price of lead and the grade of pellets purchased. Simple drop (soft) shot will be the least expensive and chilled (harder) shot will cost more. A premium grade shot will cost even more, but all this is relative to the type of factory load you are trying to duplicate. If you are trying to load shells that compare with the promotional-type (least expensive) factory ammo, then drop shot is in order. But if you want to duplicate the performance of a factory first-line field load, you should be using chilled shot. To duplicate the patterns of the premium-grade factory hunting loads or target loads you will need to purchase the very hardest and most expensive shot. There will be more on the various types of shot later in Chapter 10.

Each load carries with it specific and absolute components which must be used. If you can get a good buy on brand X wads as opposed to the specified brand Y wads, you will not be able to use them unless you can find a load specifying brand X. This regardless of what some well-meaning but uninformed salesperson might suggest about the "interchangeability" of components. So if you are bargain hunting, take along your reloading manual to see if data exists for the components you want to buy. If not, you will have to purchase the higher priced components listed in the data.

Purchasing components in larger lots, 1,000 primers instead of 100 for example, can often times save you money. This, of course, is dependent on the amount of reloading you do and the merchandising practices of the stores in your area.

However, when looking for a bargain, never purchase any component that is not in the original factory-sealed container. Some folks have purchased powder, for example, in plastic



Reloading can save the shotgunner a substantial amount of money, or simply allow for a great deal more shooting than would otherwise be possible.

bags or cans supposedly repackaged from a larger money-saving keg. This opens the door to a whole host of problems. First, the powder is no longer in an easily recognizable container, and one or more of these containers lying around the reloading bench could result in a powder mix-up. Also, the powder is no longer in a safe and approved container. This makes accidental ignition more likely, and, in the case of an accident, you may find you have failed to heed the powder manufacturer's warnings on repackaging and storage. Moreover, local law more often than not requires that powder be kept in original containers. In case of a fire, your insurance company may refuse payment due to your failure to abide by local fire codes. Similar scenarios apply to all components. Purchase only original factory packages.

Savings can also be realized by reusing fired shotshell cases. Typically, the better one-piece plastic shells can be reloaded about six times. There are two sources of no-problem cases for the novice: those obtained as the result of firing factory ammunition; and those purchased as new components. The latter are often very hard to find as not all ammo makers sell their cases as components, and few dealers stock them. There is one other source of shotshell hulls, and that is the once-fired hull. However, only the most experienced reloaders should safely purchase once-fired cases. More on this in Chapter 6.

Some shells are suitable for only one or two reloadings. These use a separate base wad and plastic tube to form the case. The base wads are sometimes made of wound paper or a moulded material. The paper wads will deteriorate with multiple firings, and both paper and moulded base wads can come loose, a potentially dangerous situation. Obviously, if a certain style case can be reloaded four, five or six times as compared to only twice for another type, it might be advantageous to spend a bit more for the better ammo or cases.

Your largest cash outlay will be the purchase of the reloading equipment. However, this cost can be amortized over years of shooting. If you purchase a good reloading press, it can literally last a lifetime. A press that costs $150 amortized at 3 cents per round means that after reloading 5,000 shells the tool is paid for. Shooting just a modest amount of ammo each year, say 1,000 rounds, the tool pays for itself in five years. Of course, a few essential extra tools will also need to be amortized.

In short, reloading shotshells can reduce shooting cost by

Purchasing components in quantity can have a bearing on actual cost. However, for safe storage, do not purchase more components than can be used in a reasonable period of time—say six months. Never purchase more components than legally allowed for storage in a private dwelling.

50 percent or more. But in reality, few reloaders actually "save" money. They simply reinvest all of their savings into shooting twice as often. Still the economics make sense even when considered from the frequent shooting logic. Twice as much pleasure, not to mention the improved level of shooting proficiency that comes with the increased frequency of shooting, is a worthwhile goal.

When asked for the secret of their shooting skill with a scattergun, almost all really proficient shotgunners will respond *practice, practice and more practice*. Reloading can make practice very affordable.

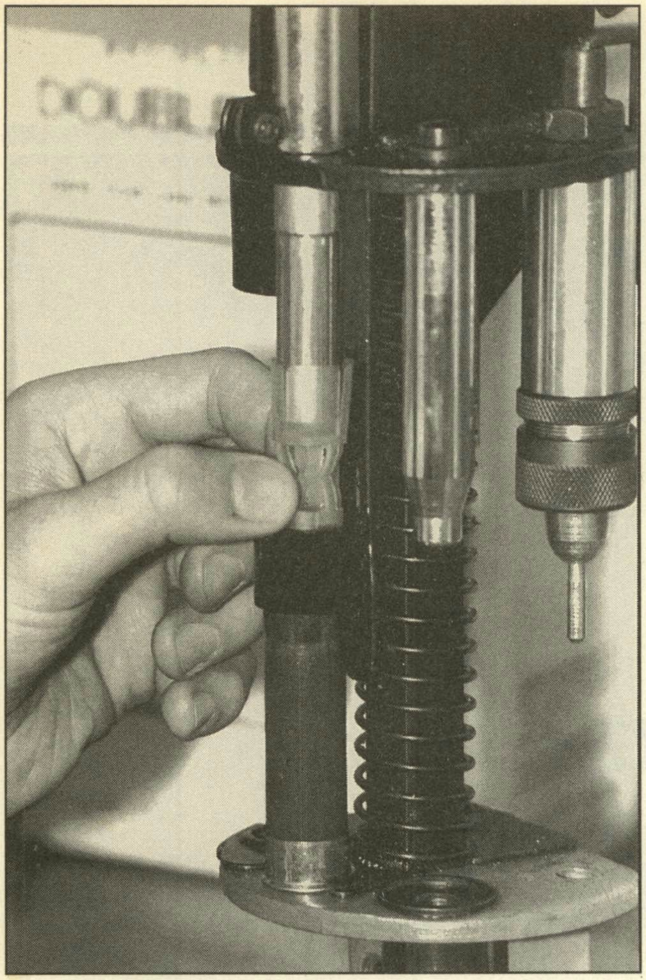
Customizing loads can add a great deal of versatility to the shooter's ammunition.

Customizing Loads

The reloader has a seemingly endless opportunity to customize loads to best fit specific hunting situations. A 12-gauge shooter can load a very low-cost and low-recoil round that has no factory equal by using a $^7/_8$-ounce shot charge. Or the reloader can make patterns open up quicker or stay together longer by using softer or harder shot than available in an equivalent factory load. Or patterns can be regulated by using differing pellet sizes, some of which cannot be purchased in a particular factory load. These and other options are part of the reloader's ability to make ammo that suits very specific needs or desires. But customizing (never experiment beyond the confines of listed data) is an advantage that is usually not enjoyed until the reloader has gained thousands of rounds of experience. In the beginning, most reloaders simply want to duplicate a favorite factory load. Doing so is not difficult.

Hobby

Hobby can be an important aspect of reloading shotshells. A lot of satisfaction comes from shooting a good score at Sporting Clays, Skeet or trap with ammo that you have



The hobby aspect of reloading shotshells is one of the enjoyable parts of assembling your own ammunition.

assembled yourself. And some shotgunners experience a great deal of elation when filling a game bag using shells reloaded at home. Also, depending on the number of rounds needed, reloading can supply hours of enjoyment. Yes, there are those who reload only to save money, but most reloaders take pride in their shooting and scoring with shells they have made. And many of these shooters learn to enjoy the time spent at the reloading bench, and at the range trying new loads.

Let's understand from the onset that reloading is not for everyone. If you must smoke, have distractions about, and load without the desire to learn the ins and outs, then you would do best to purchase your ammo. A less than fully concerned approach to reloading can be disastrous.

However, if you are willing to read a manual or two such as this one, if you are willing to double-check all data in at least two sources, and are willing to keep learning while updating data, then you are a basic reloading candidate. A mature approach is essential. If you find no problem with the fact that components can never be substituted and that the loading process must be conducted with extreme care and thought, you will probably be a safe and sane reloader. In this case, read on. When you have finished reading all the chapters, you will know if you want to reload. If you so decide, enjoy all the benefits of good reloads.

The Component Cost of Reloads

The actual component cost of a reload includes the price of the primer, propellant, wad and the shot or slug. This assumes you have obtained empty cases as the result of firing factory ammo. To determine the cost the cost of a box of 25 reloads simply reduce the cost of your components to a per round cost and multiply by 25.

Primer: Average cost is around $16 for a box of 1000 primers for a cost per shell of $.016.

Powder: There are 7000 grains in a pound of powder. Divide the cost of your powder on a pound basis, say $15, by 7000 to get the cost per grain. Then multiply your per grain cost by the number of grains used per shell. This might be $.0021 times 18.5 grains equals $.0388 per reload. Round this off to $.04.

Wads: Average cost for a bag of 1000 wads is $24. Divide $24 by 1000 for a per wad cost of $.024. Round this off to $.03.

Shot: Shot usually comes in 25-pound bags with the average cost being $15. Dividing $15 by 25, powder costs $.60 per pound. Now to determine the per ounce cost divide $.60 by 16. One ounce of shot then costs $.0375. To determine your per shell cost, multiply $.0375 by the number of ounces shot used in your reload, for example 1 1/8 ounces. The cost of shot for this load would be $.0421. Round this to $.04.

Finally, add up the costs:

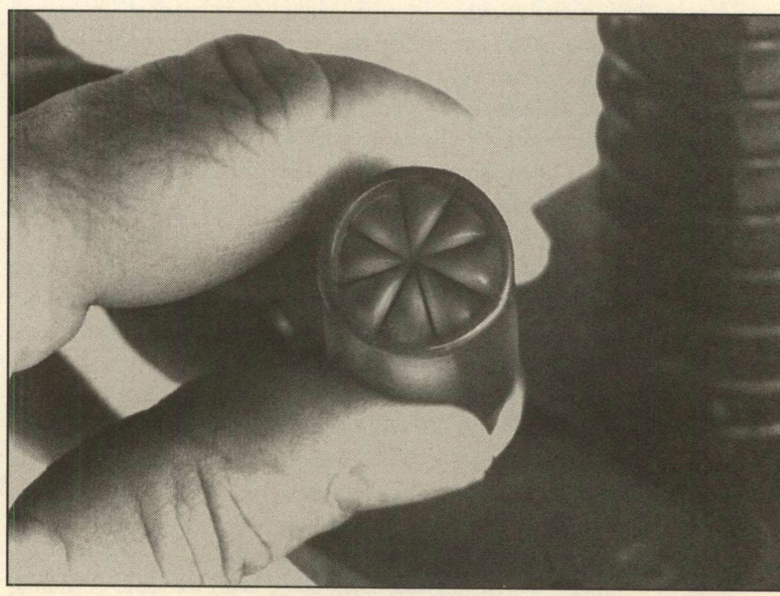
Primer	$.01
Powder	$.04
Wad	$.03
Shot	$.04
Total Component Cost	**$.12**

Now multiply 12 cents by 25 for the cost per box of reloaded shotshells which in this example is $3. With the average box of factory ammo going for $7 to $10, you can see your savings are substantial. Of course, buying components in volume will save you even more.

Not everyone should reload. But, if you are a conscientious shooter with a willingness to learn and do it right, reloading can be a very rewarding undertaking.

CHAPTER 2

Getting Started— Reloading Equipment And Bench Setup



Getting started in reloading shotshells is relatively easy. However, each individual must be willing to accept the responsibility of becoming a safe, thorough and knowledgeable assembler of ammo. Stick to all the rules, never vary the recipe and, if in doubt, ask before proceeding.

GETTING STARTED IN shotshell reloading does not require a wide range of tools and accessories. Unlike metallic cartridge reloading which necessitates the purchase of a press, dies, shellholders and an endless array of accessories, shotshell reloading requires only a press, which generally comes complete to reload a single gauge, a scale and Vernier caliper.

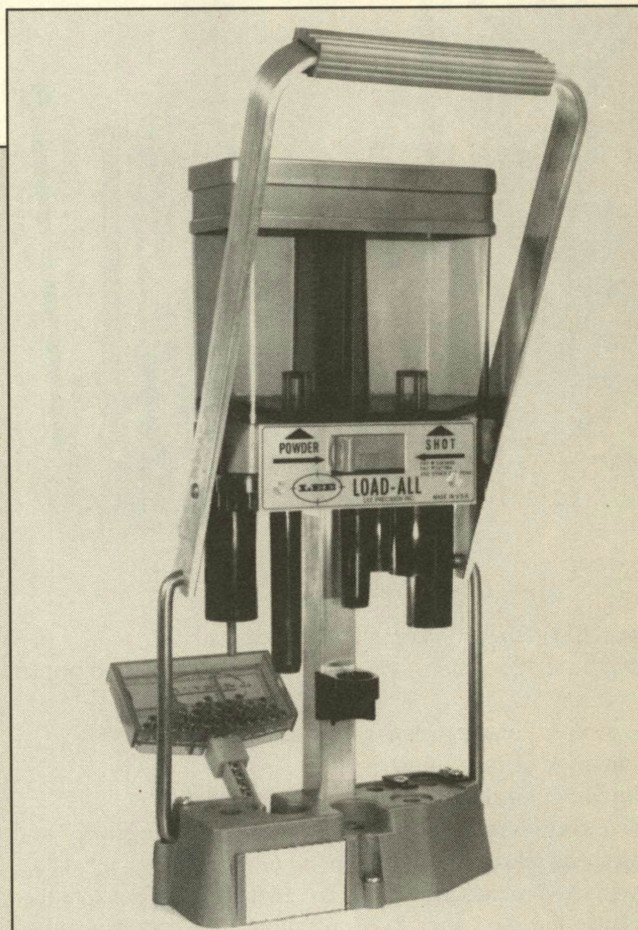
A typical shotshell reloading press will include all the dies necessary to load a specific gauge as well as powder and shot measures. After the press is properly adjusted and tested for safety, one needs simply to add powder and shot to the appropriate hoppers and have on hand a supply of empty cases, primers and wads in order to begin.

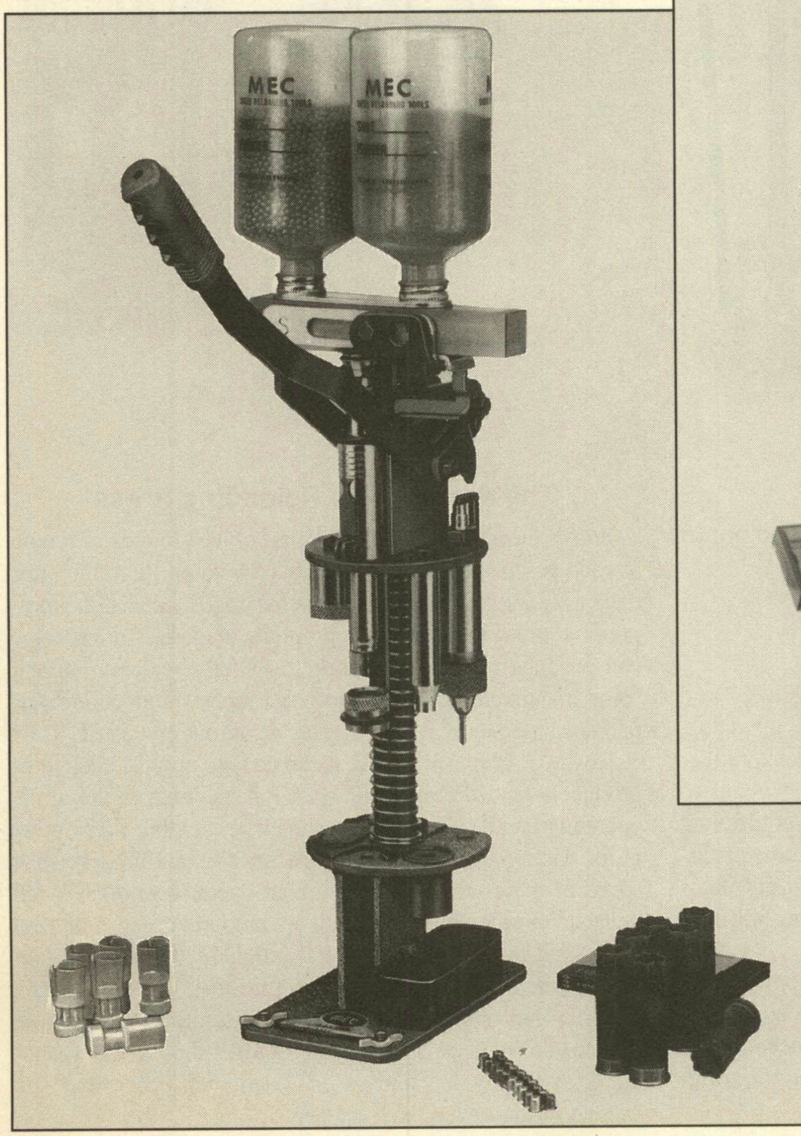
However, the proper press adjustments and safety inspection necessary at the beginning of each loading session, or when a new lot of components is introduced, will necessitate the purchase of a few basic accessories. The most important of these is an accurate powder/shot scale (graduated in the avoirdupois system) and at least two good data manuals—one published by a reliable source (such as this book) and another published by the manufacturer of the propellant to be used in the reload. Also needed will be a selection of powder bushings two steps larger and two steps smaller than the bushing anticipated as being correct. Extra shot bushings or bars, depending upon the brand of press purchased or the specific loading data selected, may also be necessary. Powder bushings and shot bars are discussed in more detail in Chapter 13. You'll also need a Vernier caliper graduated in thousandths of an inch to measure the overall length of the loaded round and the crimp depths of factory shells. Depending upon the type press you purchase and the method you use for reloading, a loading block may or may not be necessary.

The determining factors governing your purchase of a reloading press will be the number of shells you need to reload and the amount of time you have available to produce them. There are three primary press types to choose among. A non-progressive press loads one shotshell at a time at a rate of about 100 shells per hour. A progressive shotshell press loads one shotshell with each stroke of the press handle, indexing five or six shells from die station to die station. Usually 250 shells per hour can be produced on the progressive. Finally, for the low-volume reloader, a set of shotshell dies to fit an existing metallic press can be purchased and will produce twenty-five shells per hour.

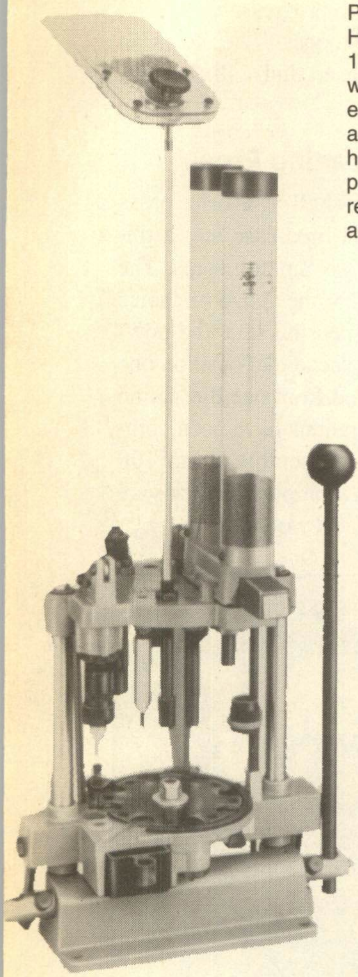
The Non-Progressive Loading Press

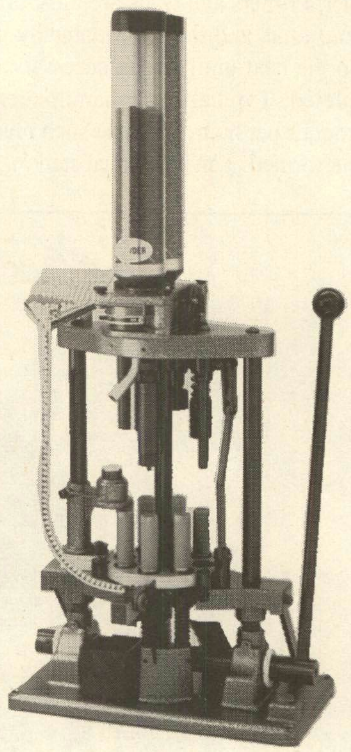
A good basic single-stage or one-shell-at-a-time press allows the reloader to process a single fired case into a finished round in a sequence of five or six smooth steps. The press generally comes set up with dies of the gauge of choice and a built-in metering system for dispensing shot and powder. Primers and wads are most often placed into position one at a time, and the shell manually moved from one die station to the next until all the necessary operations have been completed. Typically the handloader can assemble about 100 rounds per hour. On most such presses multiple operations are performed at an individual station. Typical would be:

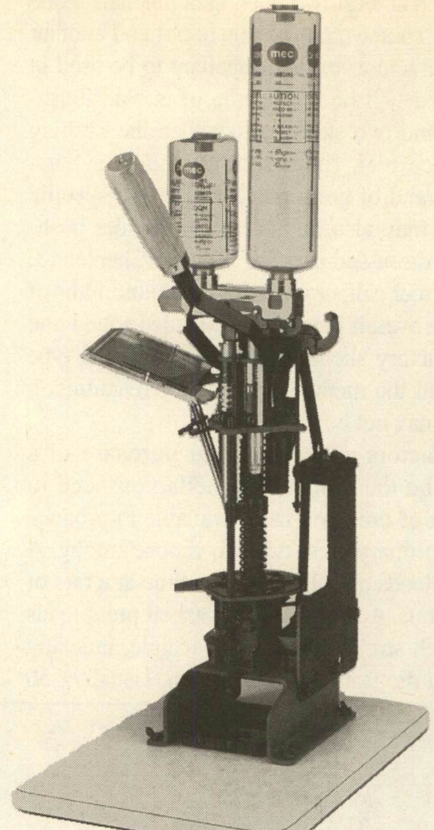


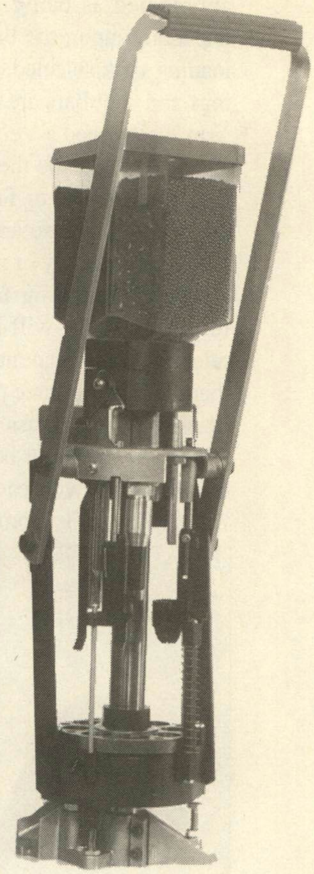


A non-progressive reloading press such as this MEC Sizemaster (left) or Lee Load-All (above) is the best choice for most reloaders. Presses of this type will allow you to load s shell from start to finish in about half a minute. Typically most reloaders can assemble about 100 shells per hour.









Progressive reloading presses like the Hornady 366, Ponsness/Warren LS-1000, MEC 9000G or Lee Load-Fast will supply a fully reloaded shell for each complete stroke of the press operating handle. For those who need a high volume production rate, this type press would be a good choice if the reloader has first learned all the basics and is willing to be extra careful.

Station 1: Fired primer removal and case sizing.
Station 2: Opening of case mouth (crimp area) and primer seating.
Station 3: Powder metering, wad seating, shot metering.
Station 4: Crimp starting.
Station 5: Final crimping.

A single-stage press is ideal for both beginner and advanced reloader. I favor it for all of my shotshell reloading. A hundred rounds per hour is fast enough, and I can carefully inspect the shell after each operation. It is advantageous to select a press that allows crimp die adjustments. As different brands and styles of cases are reloaded, it will become apparent that crimp die adjustments are necessary. If your press can't be adjusted, it will not be ideal for loading all case styles.

The same can be said for an adjustment to control wad pressure. Most loads can be assembled with 20 to 40 pounds of wad pressure during seating. However, some recommended loads will require up to 100 pounds of pressure if the crimp is to be properly formed.

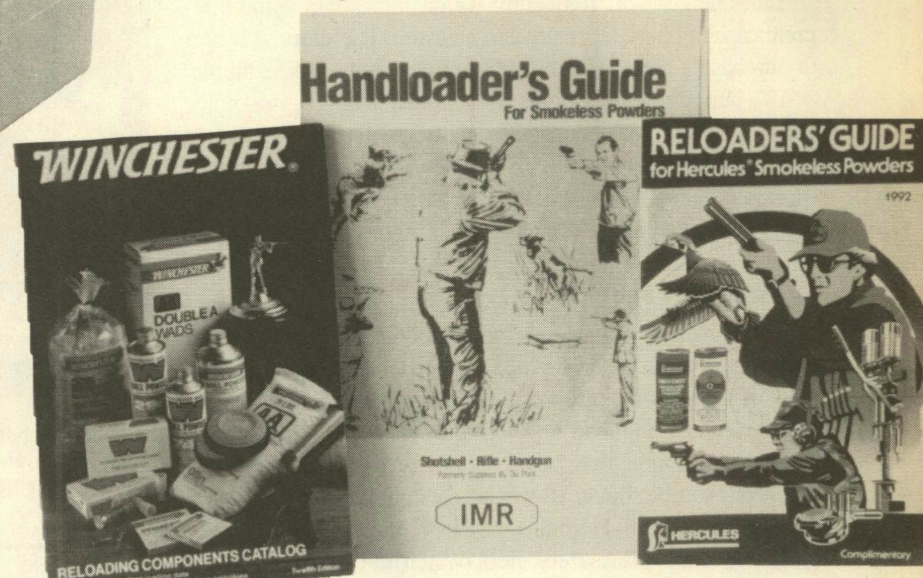
The Progressive Reloading Press

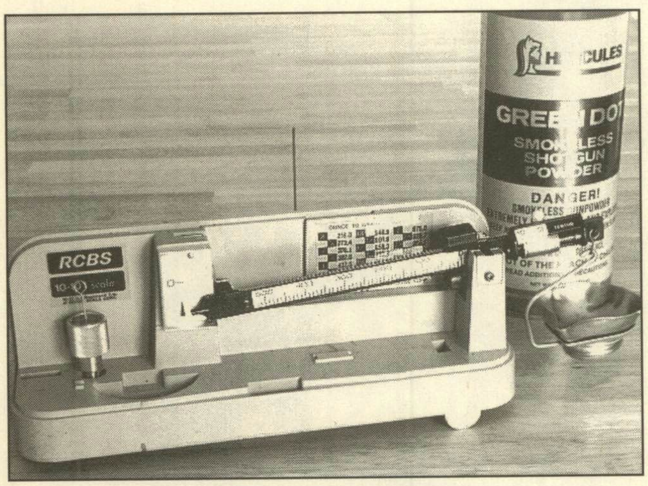
Some reloaders shoot a minimum of 100 rounds of ammo at each practice session. And they may shoot more than just once a week. If limited time for reloading is a concern, a progressive press may be the appropriate choice. A progressive can produce on average about 250 shells per hour—albeit some manufacturers do like to boast higher production rates, perhaps based on use by extremely dexterous operators.

However, this is not the best choice for a novice. Such units produce a loaded round with each full up/down stroke of the operating handle. Generally, a shellplate, holding six or more hulls, rotates each shell from station to station. Given the speed of these units, they require an operator who has a full understanding of each reloading operation in order to prevent errors and to recognize potential problems that might occur during the loading sequence. Some less knowledgeable reloader can mistakenly produce ammunition with double powder charges, missing wads, double shot charges, shot mixed with powder, and so on. Each such occurrence can cause a serious, even fatal, accident.

Shotshell reloading dies are available to convert the metallic press into a low-volume shotshell reloading press. Production rate averages twenty-five shells per hour.

At least two data sources are required to confirm the load you select and prevent the potential of using a load that was printed with an error. Select a general data reference such as this one and for the second data source select the manufacturer's data for the powder you will be using.





A powder/shot scale is a basic and essential tool for the assembly of safe shotshells. Shotshell reloaders will do best to purchase a scale with a 1000-grain capacity.

Automatic primer feeds are sometimes part of a progressive tool or are available as add-on accessories. These, in my opinion, are an added safety risk (see Chapter 7) in the loading process. I prefer progressives that allow individually hand-placing primers.

Despite the greater chances for error, a very careful person who has taken the time to learn the ins and outs of shotshell assembly can use a progressive press at a realistic pace and safely load satisfactory ammo.

Low Production Rate Presses

Metallic reloaders who hunt with a shotgun or shoot an occasional round or two of Skeet and trap may feel they would enjoy assembling loads on a small volume basis but don't want the expenditure of a shotshell press. One way to accomplish this is to use an existing metallic press. At present only the RCBS AmmoMaster, Rock Chucker and Reloader Special 3 and 5 metallic presses have a removable die bushing which will allow such a setup. Die sets in 10-, 12-, 16- or 20-gauge can be purchased to fit these presses.

Shotgunners who opt for this conversion should already have the needed powder scale and Vernier caliper and need only to purchase the basic die set, the necessary components and a loading block. Reloading is done on a batch basis. That is to say, all cases are deprimed, and then all cases are primed, and so on. In short, each basic operation is performed on all cases before beginning the next operation. About twenty-five shells per hour can be reloaded. Somewhat higher rates can be obtained if the reloader has a powder measure. Shot is measured with a volume scoop supplied with the RCBS die set. However, both powder and shot charges must be checked with a scale.

Ultimately, the type of press selected will depend upon the shooter's needs, experience and cost of the equipment. In Chapters 3, 4 and 5 the step-by-step reloading sequence of each of these three basic press types will be fully detailed. Reading these chapters can help determine which would be most appropriate for your needs.

Bench and Press Accessories

Powder and Shot Scale

The powder and shot charges dispensed by any shotshell reloading tool are not absolutes. No powder bushing or shot bar/bushing will meter an absolutely correct charge weight. Powder density can vary from lot to lot (lot numbers are usually printed on the propellant can) as can shot density. Thus, each time a component lot is changed—as you use up one can of powder or bag of shot—you must check-weigh the new powder or shot charge. **Caution:** *This operation is more complex than might at first seem. Be certain to read how to properly check-weigh these charges in Chapter 13.*

Shot charges will frequently weigh more than some 500-grain capacity powder scales can measure. Therefore, it is best to purchase a scale with a 1000-grain capacity. For example: A $1^1/_8$-ounce charge weighs 492 grains, while a $1^1/_4$-ounce charge weighs 547 grains. Scales are available as balance beam or electronic models from Dillon Precision, Lyman or RCBS. Balance beam scales are relatively inexpensive; electronic scales can put you back $300 or more.

Multiple Data Sources

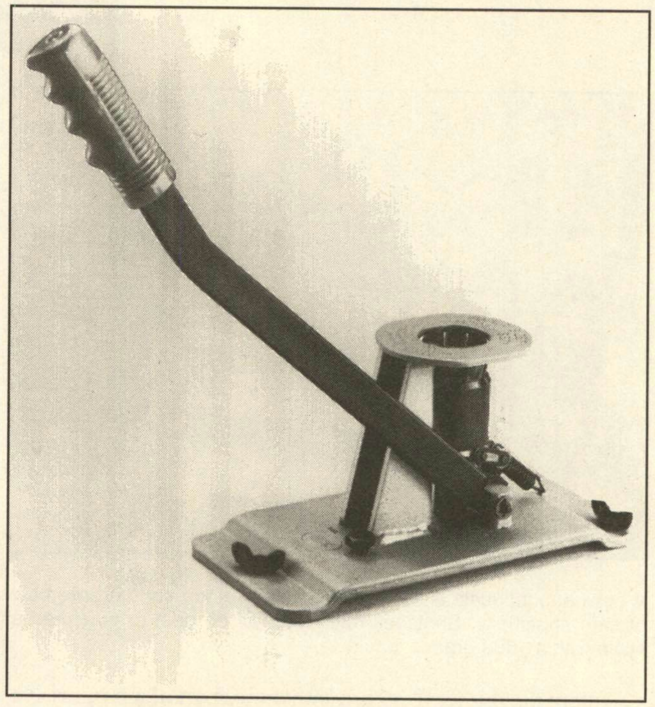
Reloading data sources are not infallible. There have been occasions when a published load has been incorrect, even to the point of being dangerous. For this reason, the reloader needs to cross-reference any load selected to at least one other source. The primary source may be a handbook such as this one. The secondary source should always be data published by the powder manufacturer—Hercules, IMR, Winchester, etc. Never omit this important safety step. When the two referenced sources disagree, do not use the load in question until you have verified its correctness with the powder manufacturer.

Powder and Shot Bushings and Bars

It is important to remember that powder bushings and shot bars/bushings do not invariably throw the charge weight specified by the manufacturer. The amount dispensed can vary greatly, even to the point of producing a load that might be dangerous. You must use a scale to check-weigh the powder and shot charges to ensure the correct amount of shot/powder is being thrown and that the volume thrown is uniform from charge to charge. (Details on this procedure are included in Chapter 13.) There is an even chance you will have to replace the bushing supplied with the press in order to obtain the proper powder charge. Shot bars/bushings, for reasons that will be discussed later, rarely require this adjustment, but must, nonetheless, always be verified by actual check-weighing.

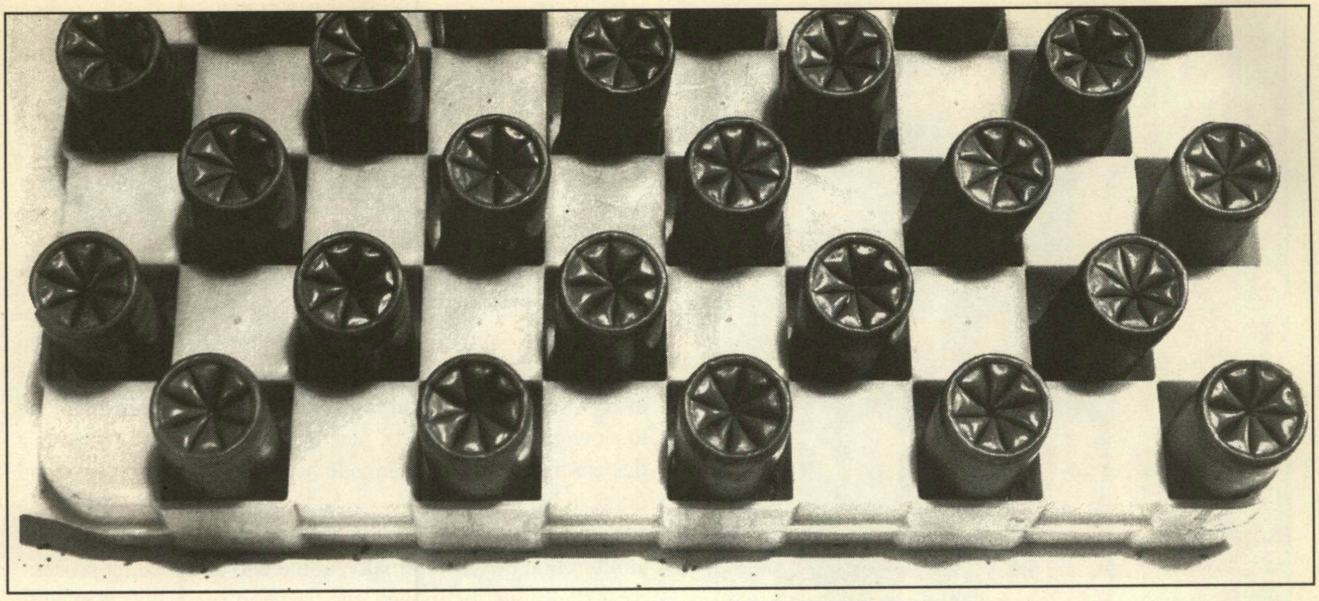
When acquiring equipment, purchase four extra powder bushings for each load you intend to assemble, two smaller and two larger. Determine the appropriate bushing numbers by referring to Chapter 13.

A good dial indicating caliper is essential for duplicating the overall shell length and depth of crimp of factory loaded shells. Overly short or long measurements can drastically alter ballistics.

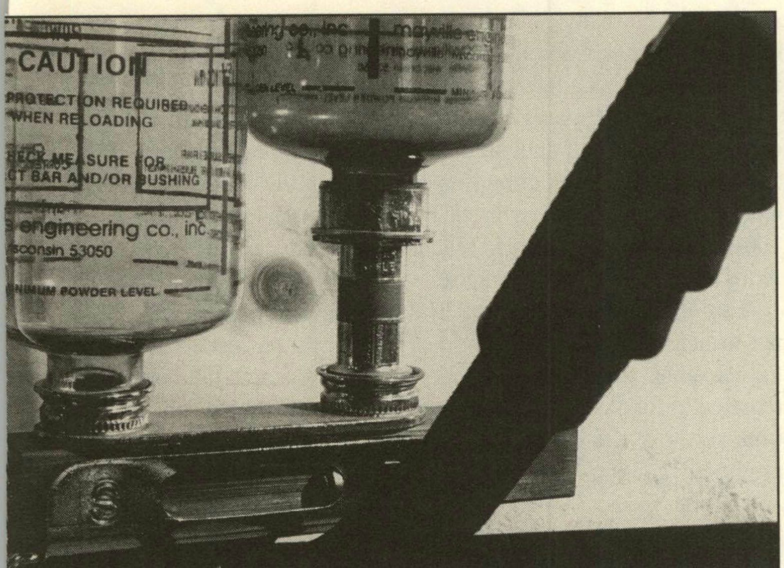


Remote sizing units are necessary when using progressive tools that do not supply a sizing die as part of the basic setup or that do not allow for heavy-duty sizing (over-expanded cases or high metal head cases).

Extra powder bushings and shot bars are accessories that will be needed sooner or later.



Loading blocks are needed when loading on a metallic cartridge press as you must batch-load ammo.



Powder measure baffles can increase the uniformity of metered powder charges.

Dial Indicating Caliper

You will need to duplicate the dimensions of factory loaded ammo if you wish to obtain the expected ballistics and performance from your assembled loads. Therefore, a caliper is a must to measure your ammo and confirm any adjustments that need to be made to bring your ammo in conformance with factory shells. Calipers can be purchased from manufacturers such as Dillon, RCBS or Lyman or from your local hardware store. They are available in grades from plastic to stainless steel and can range in price from $30 to $100.

Other Accessories

As with all hobbies, there are other accessories that can make the undertaking more enjoyable or, perhaps, add a bit of convenience to the process. Many of these do not fit a true must-have definition, but some are useful under specific circumstances.

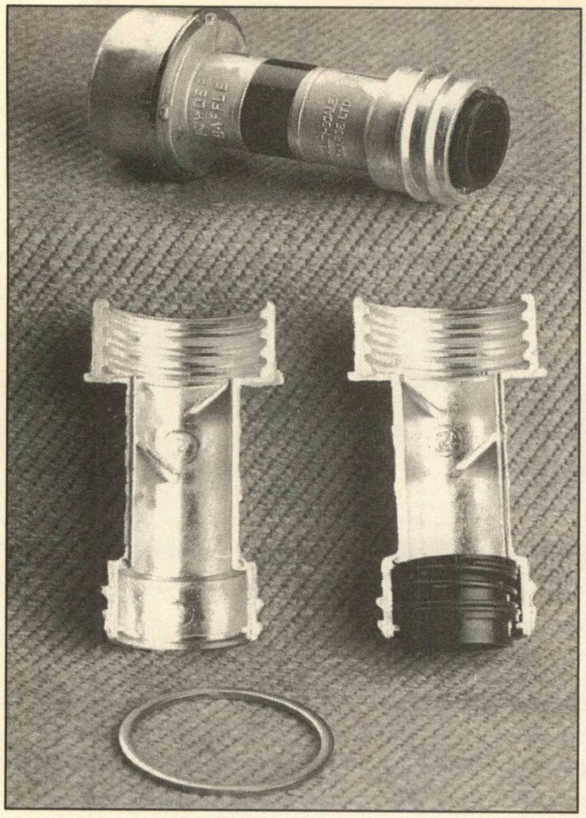
Loading Blocks are required whenever the reloader wishes to process cases on a batch basis, as described a bit earlier. They are also needed for interrupted loading sequences. For example, processing a single case to the point of requiring powder and/or shot and then setting it aside. When fifty or so cases are ready for the individually weighed charges, they are then best done as a batch. A loading block will give you a secure place to stand the cases before and during the weighing process.

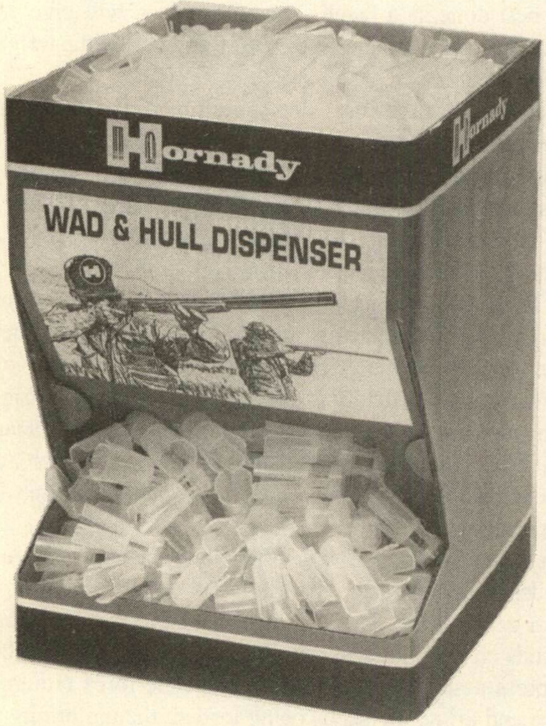
Remote Sizing Tools are sometimes mandatory since some reloading presses, especially progressives, do not include sizing dies as part of the press setup. Or you may run across cases with extreme sizing problems. This difficulty can arise when ammunition is fired in a gun with an overly large chamber diameter or in shells with high brass/steel heads. The high head cases are usually found in conjunction with high-velocity or magnum factory ammo. At this writing, all factory target loads are of a low-brass configuration.

When sizing difficulty is encountered, the reloader can use a separate case sizer prior to beginning the normal reloading sequence. This will add substantial time to the reloading process, but allows shells to be loaded which otherwise would be unusable.

Powder Measure Baffles help with charge uniformity. Powder measures meter charges based upon the volume of a given cavity size. The uniformity of the metered charge depends on many things including: the tolerances of the bushing/press assembly; the uniformity of the force required to resize and prime the shells being loaded; the uniformity with which the operator manipulates the press; as well as the uniformity of the head of powder over the bushing.

As powder is metered, the head (the height of powder in the reservoir of the powder measure) is lowered with each charge. A powder baffle placed between the powder measure


Die-cast zinc powder baffle from Multi-Scale with its spring-loaded bushing helps the consistency of thrown charges.



A wad dispenser can keep all wads neatly contained and handy for pick up as opposed to having wads rolling all over and even off the bench.

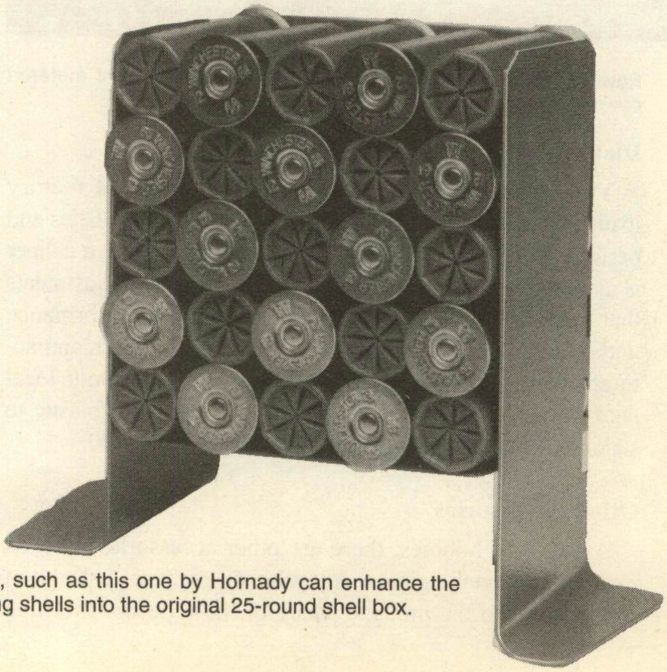
reservoir and the metering bushing will help stabilize the variations in charges. This is accomplished by using a dual chamber baffle. The first chamber supplies a constant weight of powder to feed into the second or feeding chamber. Any improvement in the consistency of the metered charge is, of course, worthwhile. Some tools include baffles as part of their construction, some do not. Buying a baffle for those that do not is a smart undertaking.

Wad Dispensers are convenient bench accessories. One of the most frustrating aspects of loading shotshells is the handling of the wads. A pile of wads poured out on the bench tends to become some wads all over the bench and some wads everywhere else they can roll. Wads left in a bag, or box, tend to slow down the effort of picking them up. Wads placed in a dispenser such as the one made by Hornady become easy and quick to handle.

Shell Packers aid in placing loaded rounds into bulk ammunition boxes. Normally, at the end of a loading process, each shell must be moved one-by-one from a bulk container into the original twenty-five-round boxes. Instead, by putting each shell as it comes from the loading machine into a packer such as the Hornady Shell Packer, one simply slips the box over the full packer and then withdraws it resulting in a filled box of shells in but a few seconds.

Plastic Shell Boxes are much sturdier than the original cardboard 25-round shotshell boxes. You'll soon find the cardboard will wear out and no longer securely hold your ammo. These inexpensive plastic boxes are available in 25- or 100-round capacities from MTM Moulded Products, Midway Arms and several other suppliers.

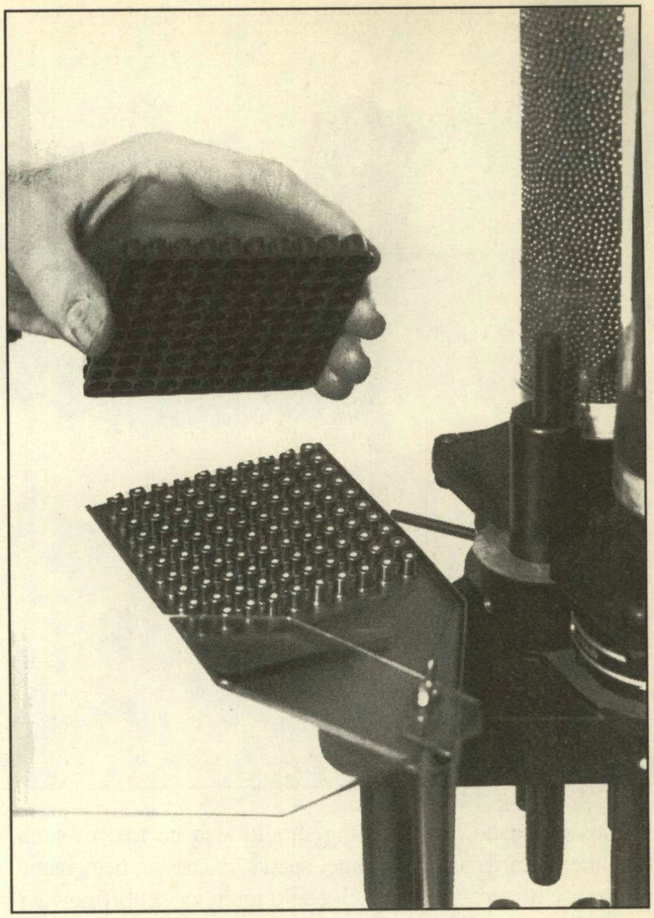
Auto Primer Feeds are used by some reloaders who prefer not to handle primers. Each primer is properly positioned at the reloading press' priming station. Of course, some time is required to fill the automatic primer feed's magazine, thus the time saved in the loading sequence is not as great as first might be thought. Extreme caution is required when using auto primer feeds.


A shell packer, such as this one by Hornady can enhance the speed of getting shells into the original 25-round shell box.

Extra Die Sets to reload another gauge are available, and some manufacturers do offer presses in which die sets can be interchanged. There is no doubt that an additional die set is less expensive than a complete new press. But in the past thirty-five or more years that I have been reloading shotshells, I have yet to speak with a single person who found extra die sets convenient. It simply takes too long and involves too many trial-and-error adjustments to make it practical to tear down a press fully adjusted for one gauge and readjust it for another. The best solution, in my opinion, is to purchase another press. Even if you load for three or more gauges, this winds up saving a great deal of time as well as eliminating all the components wasted in adjusting a press when setting up over and over again.

There is an exception to this approach. Some presses, those on the expensive side, have removable turret heads. The dies can be left in place and the entire turret head removed and reinstalled. Even then, however, some adjustment is usually required.

I find die adjustment so tedious that I own two presses for 12-gauge reloading. I keep one set up for my favorite target load and another for my favorite hunting load. Ditto for 20-gauge—one press for target loads and another for hunting loads. In the past when I had limited bench space, I usually had only two presses installed on my bench. (The ones I use mount quickly with three nuts and bolts.) I am now fortunate enough to have a 12-foot bench for shotshell loading, and I keep four presses mounted on the bench. A fifth press, set up for steel shot loading, is stored away until needed, and then it is a simple matter to unbolt one of the bench presses and replace it with the steel shot press.



Automatic primer feeds can speed up the loading operation. However, when primers are placed into bulk storage (as they would be in the auto feed magazine) they represent a potential risk with respect to spontaneous ignition. Auto primer feeds are best used by an experienced reloader who has learned the caution required.

Setting Up the Loading Bench

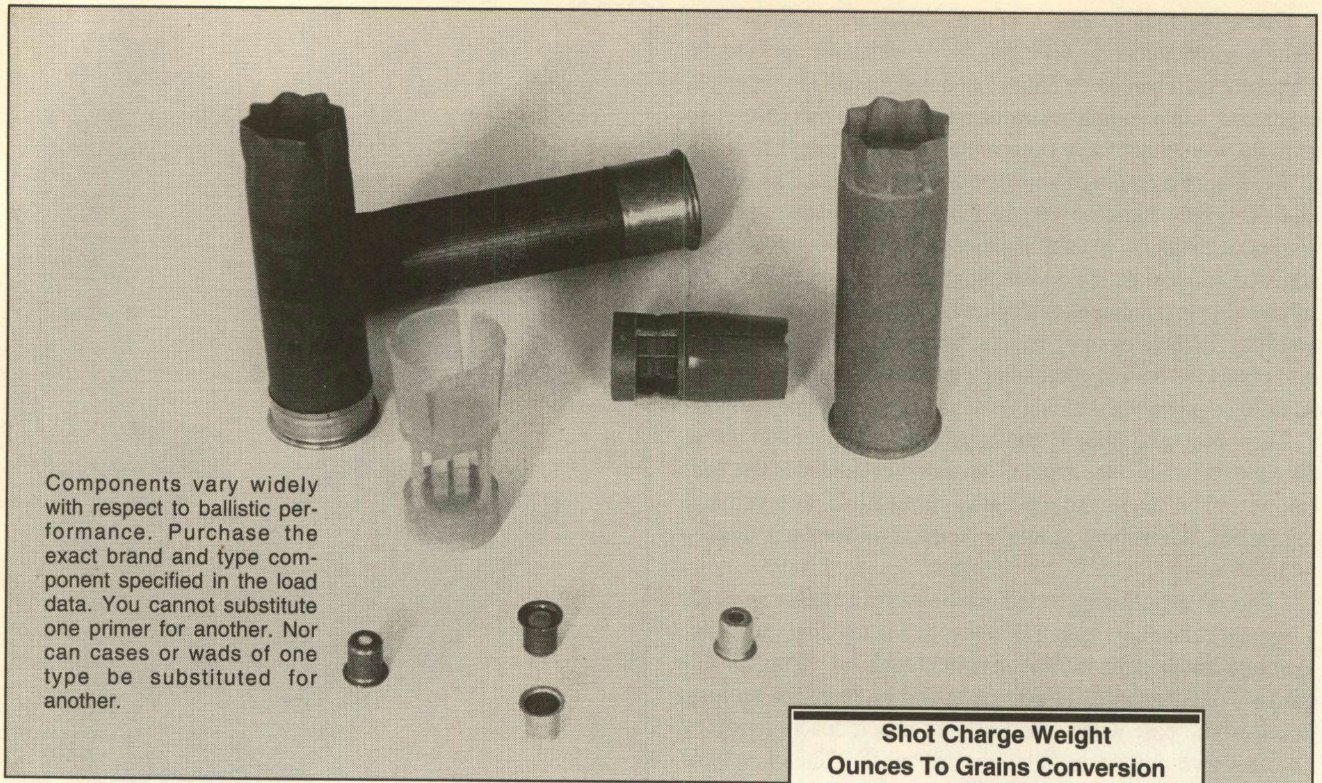
Reloading shells demands the absolute in attention. Any distraction might result in an error or omission. Therefore, the reloading bench must be located in a remote portion of the household, away from family traffic, noise, telephones or any other potential distraction.

Tools and Accessories Needed To Reload Shotshells

- Reloading press with dies of appropriate gauge
- Powder/shot scale
- Two reloading data sources
- Extra powder bushings
- Extra shot bars or bushings
- Dial indicating caliper

These items, the press, extra bushings, scale, caliper and loading block, will generally cost the beginner less than $300, depending upon the make and sophistication of the tools and the pricing policy of the retailer/dealer. Some reloaders buy upscale equipment from the start, and some begin with the most economically priced tools. Generally speaking, it pays to purchase the tools you believe will suit all of your anticipated needs for loading a wide range of loads.

The original factory ammo cardboard boxes often fall apart before you are through with the reloading life of a case. Plastic boxes are available from folks like MTM and others. You can chose between 25- or 100-round styles.



Components vary widely with respect to ballistic performance. Purchase the exact brand and type component specified in the load data. You cannot substitute one primer for another. Nor can cases or wads of one type be substituted for another.

The area used for reloading should also be free of such potential hazards as open flame, sparks, excessive heat, static electricity or percussion which could ignite or set off powder or primers. Examples of needless hazards might include electrical outlets at the bench surface level, storage shelves above the bench, heating elements or ducts nearby, unprotected lighting over the bench and so on.

I remember one individual who loaded ammunition and cleaned firearms at the same bench. Normally the two were never mixed, but on one occasion he interrupted his reloading to wipe out a barrel. In handling the shotgun he broke a light bulb and this in turn ignited a small quantity of exposed powder on the bench. He was lucky, but other "freak" accidents have caused some very unhappy circumstances and even serious injury.

The bench should also be located away from the powder and primer storage areas and both of these areas away from any area containing corrosive materials, flammables, solvents, etc. A great deal of information on the proper storage and use of primers and propellants will be offered in Chapters 7 and 8. Such information should be carefully considered before choosing a bench location.

The bench itself should be large enough for the mounting of the chosen reloading press; the placement of the necessary cases, primers and wads around the press; and for the uncluttered use of the reloading scale. Generally, shotshell reloaders find the minimum bench space for orderly and safe ammo assembly to be 3 feet long by 2 feet deep. For a two-press setup, a maximum of 6 feet by 2$^1/_2$ feet is needed. The rule of thumb is to add three feet of bench length for each additional press, or simply make the smaller bench do by unbolting and replacing one press with another as needed.

Shot Charge Weight Ounces To Grains Conversion Table

Charge (oz.)	Charge (grs.)
$^1/_2$	219
$^5/_8$	273
$^3/_4$	328
$^7/_8$	383
1	438
1$^1/_8$	492
1$^1/_4$	547
1$^3/_8$	602
1$^1/_2$	656
1$^5/_8$	711
1$^3/_4$	766
1$^7/_8$	820
2	875
2$^1/_8$	930
2$^1/_4$	984

Components

Component purchases, at least in the beginning, should be kept to basics. If you want to reload Winchester AA cases then purchase Winchester primers and wads. Ditto for matching Remington or Federal cases, wads and primers. This generally will guarantee component compatibility and will assure plenty of reloading data. Only on very rare occasions will this basic approach keep you from duplicating a factory load.

Always use the appropriate components for a specific load. Winchester, Remington and Federal, for example, all make quite a few wads in each gauge. However, only one specific wad will be the one needed for a specific load. More on component variations and selection will be discussed in later chapters. Read all of the following material before you actually begin to reload, including the in-depth look at selecting a load in Chapter 16.

CHAPTER 3

Step-By-Step Reloading On A Non-Progressive Press

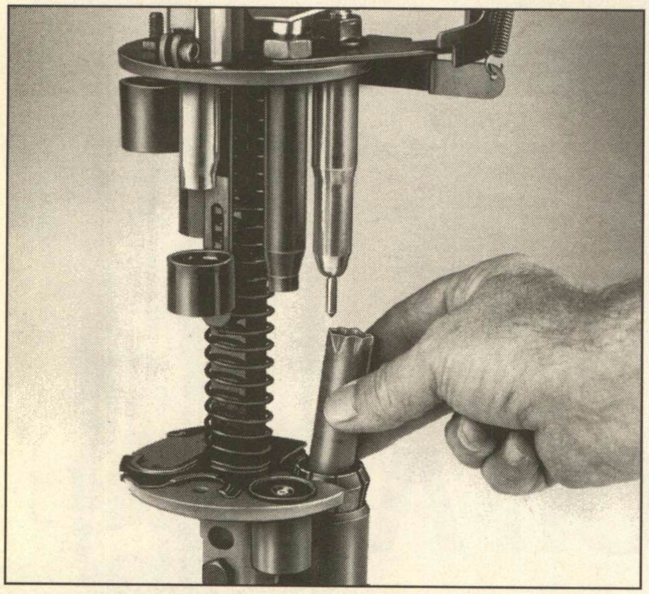
Reloading machines come equipped with all the dies, bushings, bars and accessories to fully reload one shotshell gauge. They are basically self-contained units which require few if any adjustments in order to begin the reloading process. Shown here is the MEC Sizemaster press which is used to describe the basic

FOR THE MOST PART, the actual process of reloading shotshells is straightforward. What follows is the step-by-step process on a non-progressive press. This type of press loads one shell at a time, the shell manually moved from die station to die station until all operations have been performed. The case body and metal head is full-length resized; the fired primer removed (decapping); a new primer seated (priming); the powder charge dropped; the wad seated; shot charge dropped; the crimp started and the final crimp applied.

There may be minor operational differences between the MEC Sizemaster used here as our example and single-stage presses from other manufacturers. However, the differences are usually minor and are adequately covered in the instruction booklet that comes with the press. The reloading steps described here are based on the MEC Sizemaster primarily because of its widespread distribution and acceptance by reloaders. Reading these step-by-step instructions will familiarize you with all the operations necessary to assemble a

STEP 1

Sizing Cases and Fired Primer Removal



Note: On the MEC Sizemaster used for these instructions, shells progress from the right rear station in a clockwise direction to the left rear station. Before beginning, place all of the empty cases to the right side of the machine if you are right-handed. It helps if you place them in a shallow container as opposed to simply having them spilled on the bench.

Pick up a fired case, making sure it is free of foreign matter, and place it into the sizing collet at the first station of the loading tool. Pulling down on the press handle with the left hand resizes the fired case and removes the spent primer.

Resistance will be felt as the sizing collet engages the brass or metal head on the case and the decapping pin starts to push out the fired primer. Be certain to pull the press handle all the way down to ensure the case is fully sized. The amount of resistance during sizing and decapping can vary. The longer metal heads of high brass factory magnum or high-velocity loads require more effort than the short metal heads typical of field and target loads. Additionally, large diameter shotgun chambers will result in larger diameter fired cases, hence more effort will be needed to resize the case.

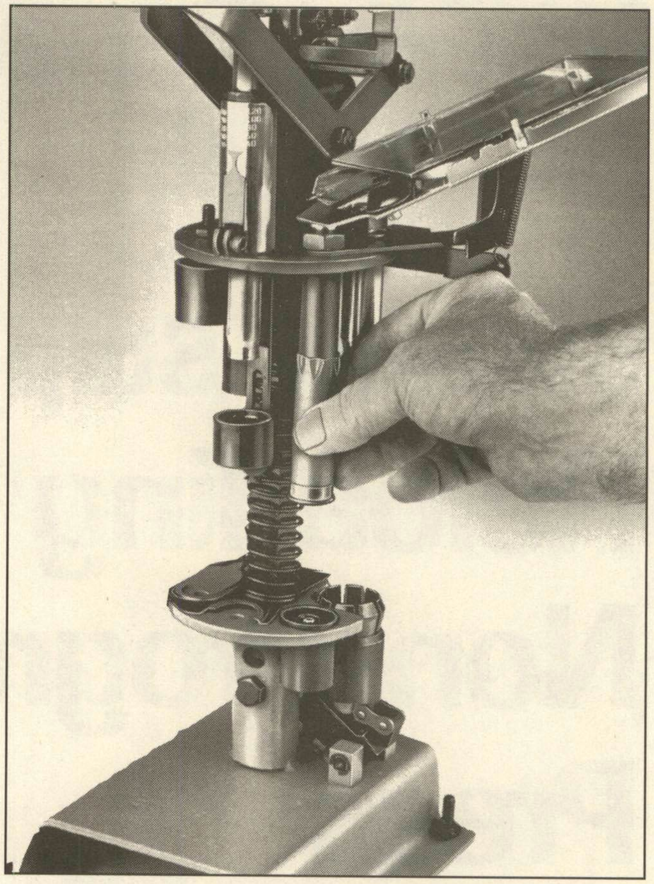
Caution: *If you encounter shells that require undue resizing force, it may indicate cases that have been fired in a chamber larger than SAAMI specifications. Do not continue. Discard the entire lot as being oversized.*

During this same operation, the case mouth fold is opened wide enough by the large upper diameter of the decapping ram to accept a wad in a later reloading step.

Raise the handle and remove the case from the sizing collet with the right hand.

STEP 2

Repriming the Case



Caution: *Always check to make sure there is no foreign material in the primer station before placing the primer into it. If a loose pellet or other material falls into the primer station, the primer could be ignited during seating and present a hazard to the reloader.*

The new primers should be placed on the left side of the press. With the left hand, place a primer into the primer station. Then lay your left hand on the press operating handle while simultaneously positioning the shell up onto the priming station ram (reprime punch). Pull the press handle down until the primer seats fully into the case. There is learned "feel" to primer seating. The press handle needs to be lowered only until the primer's battery cup engages the mouth of the primer pocket. Excess pressure should be avoided. After a few practice rounds, you'll get to know the right "feel" of a properly seated primer. It should be just a hair lower than flush with the case head surface. Raise the press handle and remove the primed case from the priming ram with the right hand.

Read the entire chapter before performing the sequence shown.

STEP 3

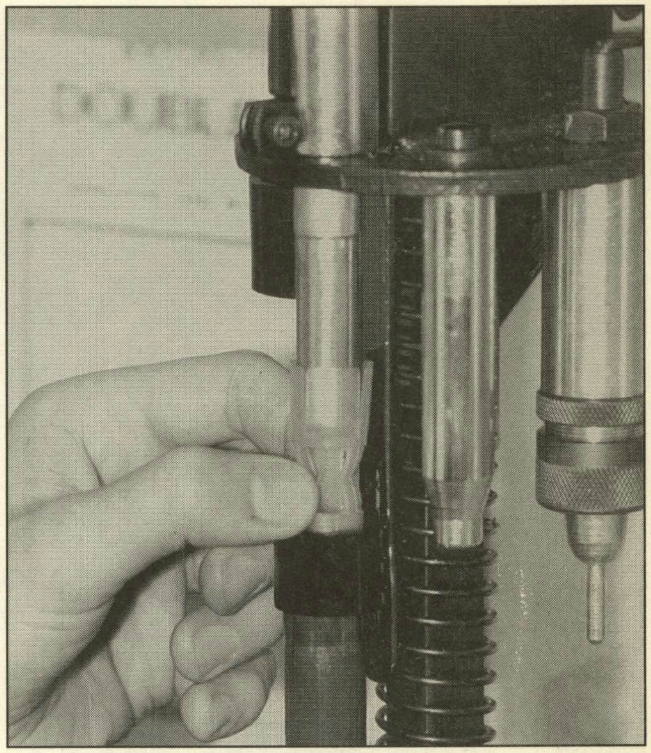
Powder Charging

Caution: *The powder charge must be verified at the beginning of each loading session. The manner in which it is checked is critical and is covered in Chapter 13.*

Slip the case into the shellholder at the middle station of the reloading press (directly beneath the wad guide), still using the right hand. Now, pull the press handle down using the left hand and hold the handle in this position. Using the right hand, push the powder/shot metering bar from right to left. A powder charge will drop into the case and the wad guide will be positioned onto the case mouth. Raise the press handle fully with the left hand.

STEP 4

Seating the Wad

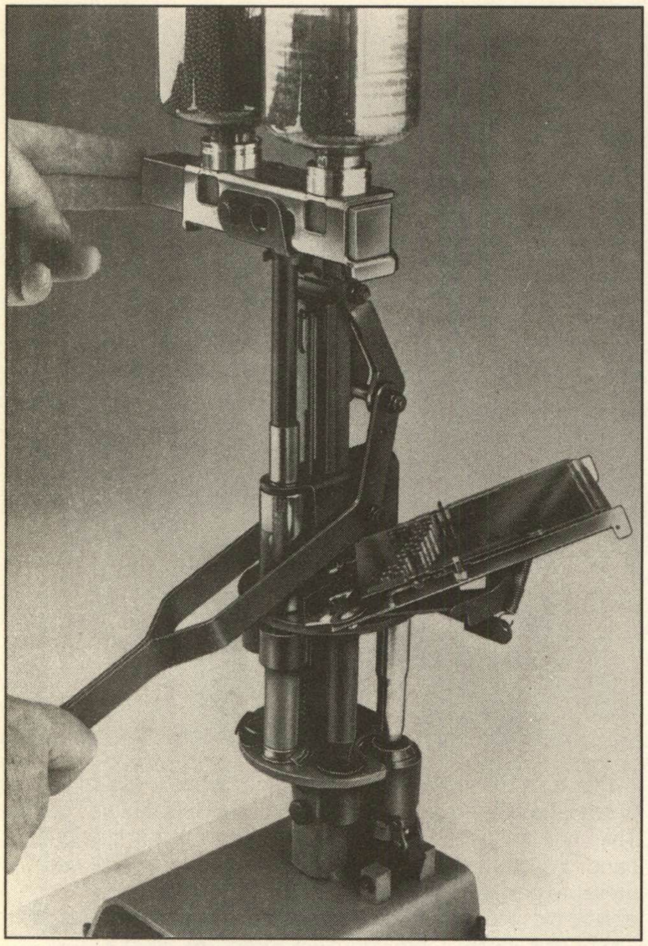


Pick up a wad with the left hand (keep wads to the left of the press for easiest manipulation) and place it into the wad guide. Then pull the press handle down, but this time use the right hand to do so. This will seat the wad into position. The wad pressure gauge should read a minimum of 20 pounds to ensure that the wad is seated against the powder without any air space between them. More wad pressure, up to a maximum of 100 pounds, may be required for certain loads in order to obtain a good crimp. Proper adjustment of the wad ram pressure is important if a good crimp is to be formed. Refer to the press operating manual for ram pressure adjusting procedures.

Read the entire chapter before performing the sequence shown.

STEP 5

Dropping the Shot

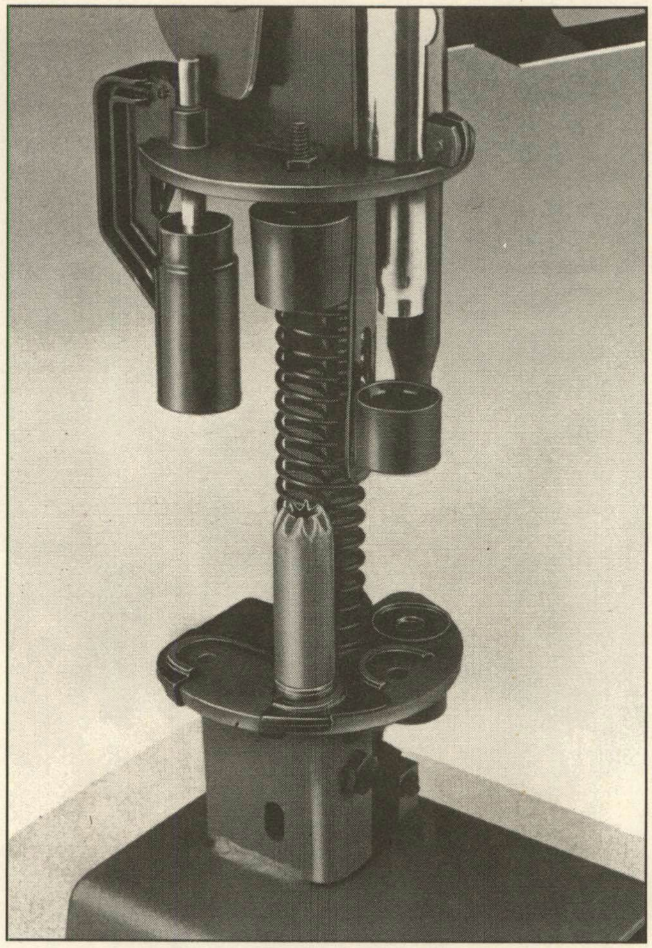


With the press handle held down, move the shot charge bar from left to right with the left hand. This will drop the shot into the case. Now raise the press handle.

Caution: *The shot charge needs verification at the beginning of each loading session. Do so by following the instructions in Chapter 13*

STEP 6

Starting the Crimp

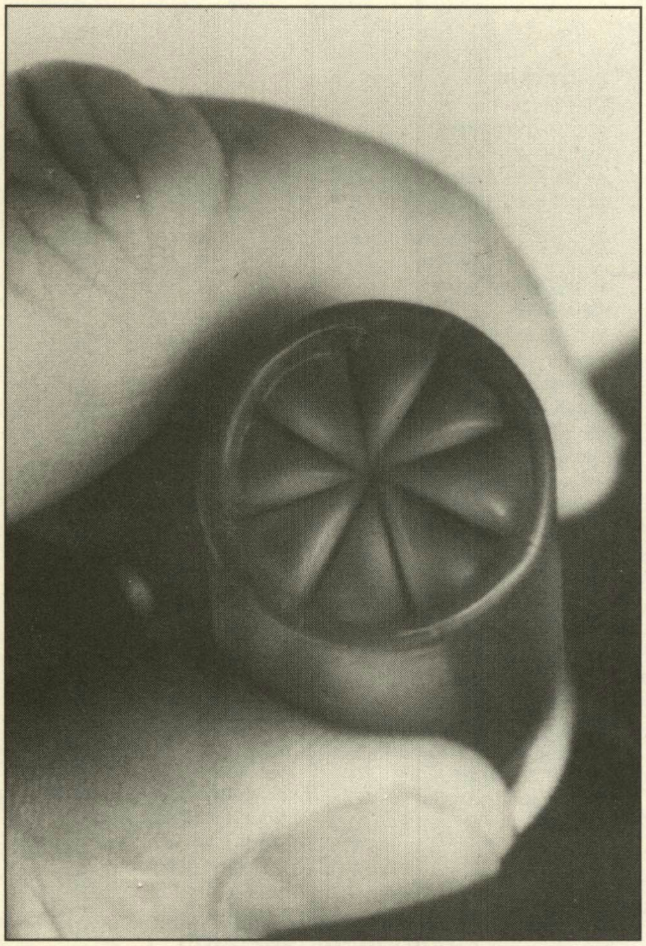


With the left hand, remove the shell from the powder/shot charging station and slip it into the shellholder under the crimp starting die. Pull the handle down with the right hand to form the crimp start. The die should be adjusted so it closes the case mouth at least two-thirds of the way. Then raise the press handle. **Note:** The crimp start die must match the original factory crimp. For example, a case originally loaded with a six-point crimp must be reloaded using a six-point crimp starter. Most cases that are popular with reloaders have an eight-point crimp and therefore must be reloaded with a eight-point crimp starter

Read the entire chapter before performing the sequence shown.

STEP 7

Forming the Final Crimp and Final Inspection



Finally, slide the shell into position under the final crimp die, using the left hand. Pull the press handle all of the way down and then up with the right hand. Remove the fully loaded case from the reloading machine. The crimp should look very similar in shape and depth to a factory load. If it does not, the crimping die needs adjustment. Follow the press manufacturer's instructions to do so. Also read Chapter 11: Crimps and Ballistics.

After removing the loaded round, carefully inspect it. Look for poorly formed crimps, case mouth and body splits, bulges, improperly seated primers or any other reason to reject the shell. If the shell passes inspection, you are ready to load another. If the shell does not pass inspection, correct the problem and/or adjust the loading press.

Caution: *Do not use any ammunition that does not pass your visual inspection. Discard all such ammunition in a safe manner*

Read the entire chapter before performing the sequence shown.

complete round of ammunition. This knowledge will translate to any single-stage press you select, regardless of make and model. A careful handloader can expect to assemble about 100 rounds per hour on this type press.

Case Selection, Segregation and Inspection

Cases should only be collected after firing factory ammunition in your shotgun, never from general range pick up. Cases lying on the ground at the range may not have been picked up for good reason. They have been fired many times and show signs of deterioration or damage not readily apparent to the novice.

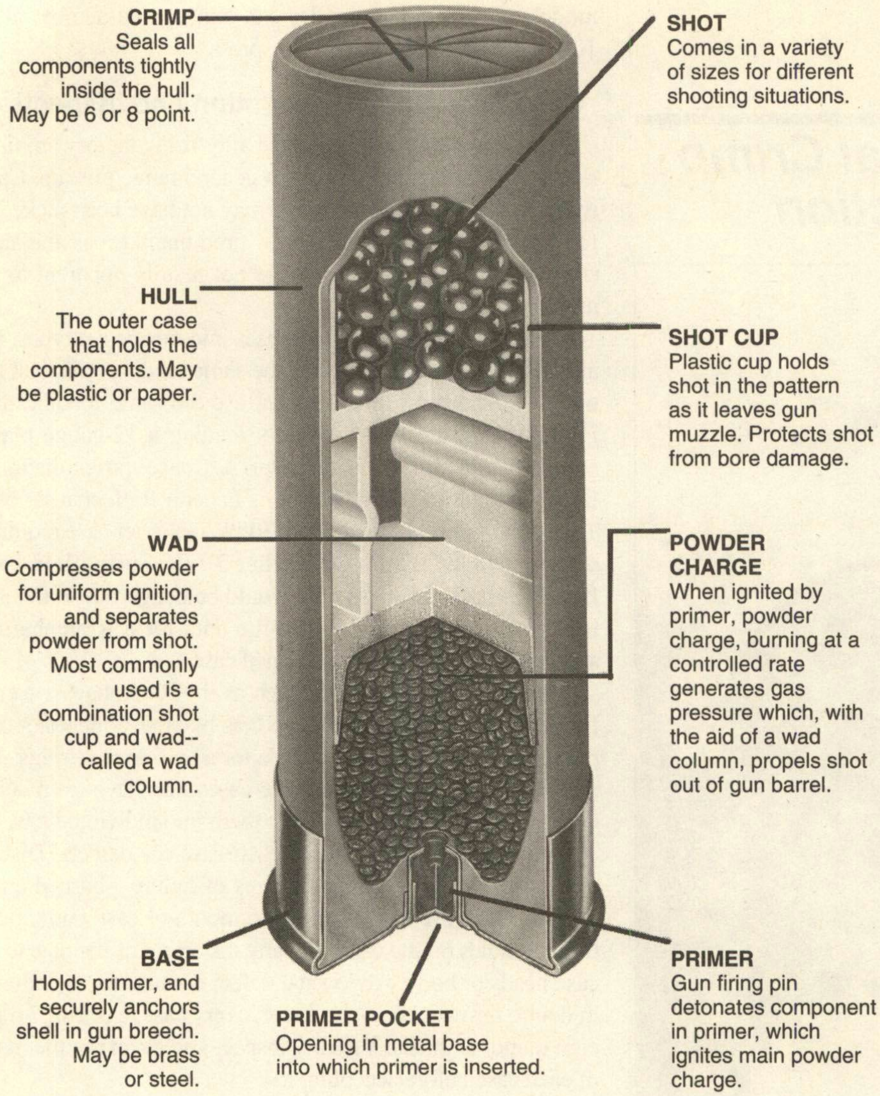
Always carefully segregate cases into distinctive types. Not all shells of a given gauge use the same loading data, just like not all 30-caliber rifle cartridges use the same loading data. For example, the data for safely loading a 12-gauge plastic compression-formed Winchester AA case varies distinctly from the data for a Winchester or Federal Riefenhauser case. This is the same as a 30-caliber 308 Winchester case requiring different loads than a 30-caliber 30-06 Springfield case. Indeed, just as the 30-06 data would be dangerous in the 308, it is equally dangerous to use the data for a Riefenhauser-style case in a compression-formed case.

Also some types of cases such as the Reifenhauser can be fired only three times whereas others like the Winchester one-piece plastic case may be suitable for a half-dozen firings. The reloader must learn to recognize cases that have even subtle differences and then to segregate them into individual lots.

After segregation, examine each case for defects. Discard any case showing even small signs of failure—burned crimp area; splits in the crimp area, case mouth or case body; burn-through holes on the case; and any distortion or damage to the case heads or body. Any visual defect is cause for rejection. If in doubt, throw it out! Also invert every case, ensuring no foreign matter is inside. Visually inspect and clean out the inside of each case before accepting it.

For cases of the Reifenhauser type, or paper-bodied cases, pay particular attention to the base wads which deteriorate with each firing, depending upon the exact load fired in the case. The base wads may be made from moulded plastic, tightly wound paper or other material. When the shell is fired, some gas may get between the obturating lip of the base wad and the case wall, forcing a gap to form between the wad and case wall or bits of the base wad may break off or burn. If these conditions exist, the case must be discarded. The inspection for this problem must be done visually.

Sometimes, however, visual inspection is not sufficient. The fired cases may look normal when, in fact, the base wad has actually loosened and moved forward in the case. When this occurs, the case represents a serious risk to the reloader and it must be discarded. Inspection for this problem is done with a dowel rod. Using a dowel of slightly smaller diameter than the case mouth, insert it into a once-fired factory load that has no deterioration. Make a mark on the dowel flush with the case mouth while the dowel is firmly against the base wad. If, when inspecting other cases, this mark does not align with the case mouth, the base wad/case integrity has been



This cutaway shell shows the various components the reloader will replace during ammunition assembly.

compromised and the case should be destroyed and discarded.

Because of all the extra inspection and possible dangers required when reloading these cases, it is strongly recommended the reloader assemble ammunition only with one-piece cases such as the Winchester compression-formed AA, Remington RXP or Federal Gold Medal types. Only the most experienced and knowledgeable reloaders should attempt to use non-unibody cases. Even then, never fire a case having a separate base wad more than three times. This means the original factory load firing and two reload firings—but only if case inspection reveals the case is suitable for each additional use. For more details on case segregation, inspection, and other case information refer to Chapter 6: Shotshell Cases, Selection and Identification.

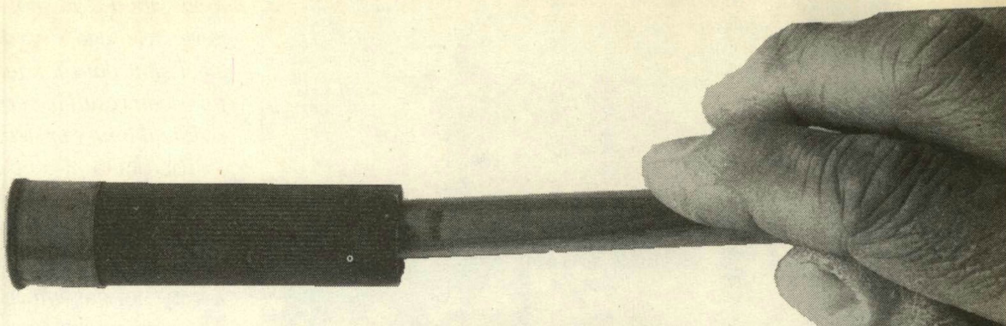
Once all cases have been inspected and segregated by exact type you are ready to begin reloading a specific type case. Remember never load cases of differing types with the same recipe!

Component Selection

Component selection is based upon the specific recipe selected for the case in use. Refer to the reloading data section for the gauge; type of load (heavy field or magnum, field, light field, or target); shell length; and specific shell type for the corresponding primer, powder and wad needed. Make a note of these and purchase only the exact listed components. But, before actually purchasing any components be sure to read the chapters dealing with components.

Then, take along your reloading manual when shopping. If you are unable to locate one or more component items needed, you can look up another load for which you can obtain the needed primer, powder and wad. Do not let any salesperson tell you that one component can be substituted for another. (See the chapters dealing with specific components for the few rare occurrences of true interchangeability.)

With respect to shot, purchase the size you need based on your satisfaction with previously used factory loads or on



If the reloader must use Reifenhauser-style cases, the base wad position must be verified with a homemade marked dowel.

information contained in the shot chapter. The various grades of shot (dropped or soft, poorest; chilled or hard, average; magnum or extra hard, best) will give patterns of varying density. For most applications chilled shot will be satisfactory.

Installing Proper Powder Bushing & Shot Bar

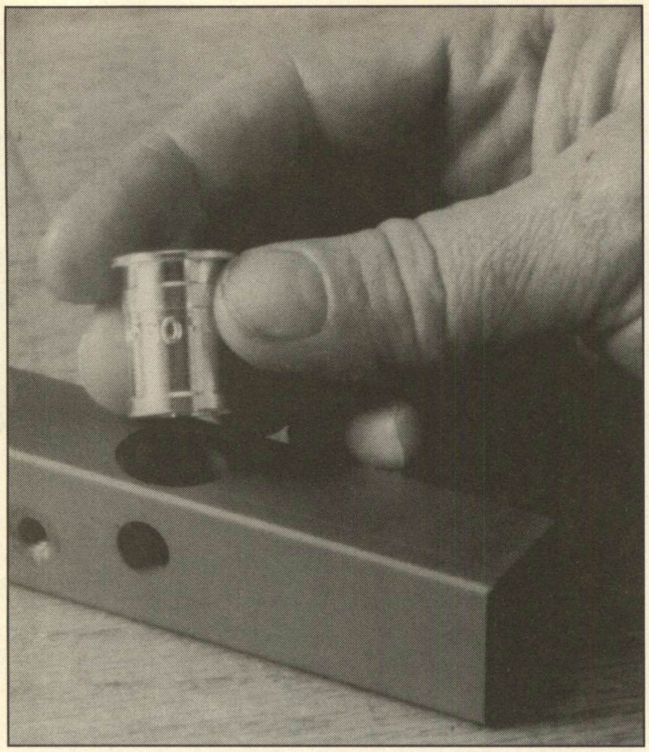
This is a vital step prior to the actual reloading process. Using the wrong shot bar or powder bushing can be extremely dangerous. First, carefully match the shot charge bar with the shot charge weight you wish to use. Then, install it on the press. Next, select the powder bushing listed for the propellant and charge weight you wish to load. Double-check the bushing as you install it into the machine. **Caution:** *The powder charge thrown by the powder bushing will not necessarily correspond to the charge listed in the manufacturer's bushing tables. The actual charge delivered may be lighter or heavier. It is essential you read Chapter 13: Shotshell Bars and Bushings, before beginning to reload ammunition.*

Component Verification

Take the can of propellant and the selected box of 100 primers from your remote storage area and place them on the loading bench along with the bag of wads and the shot. Open your data book and verify the load to be used. Double-check all the components you have placed on the bench to ensure they are what you must use.

Now double-check that the right powder bushing and shot bar are installed in the tool. Now fill the press shot and propellant containers. You are ready to begin the reloading process. **Caution:** *Never use a shot bar (or bushing) that is meant for steel shot when reloading with lead pellets. Equally, never*

Select the exact components that are specified in the chosen reloading data. Never substitute one component for another.



Install the correct powder and shot bushing for the load selected. Verify thrown charge weights with an accurate scale as bushings and bars will throw varying charges dependent upon a number of conditions. The actual charge thrown may be heavier or lighter than specified by the bushing manufacturer.

load with a lead shot bar in place when using steel shot. Also never use lead shot data with steel shot. Likewise, never use steel shot data for lead pellets. Failure to follow these cautions can result in very dangerous pressure which could cause physical injury or death.

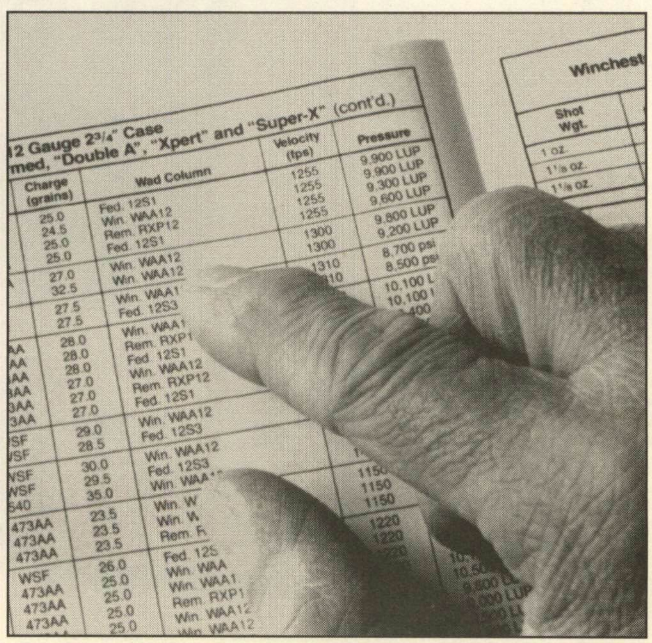
The photo of a cutaway shotshell shows the various components the reloader must replace. Naturally, the ejecta (propellant, wad, and shot) are all pushed from the shotshell case upon firing. (The powder is actually consumed and escapes as a very hot gas which pushes wad and shot from the barrel.) The case, which expands to approximately chamber diameter, must be resized to a smaller diameter to closely match the diameter of a new factory shell. The fired primer must be manually removed and replaced, Then propellant, wad and shot are added and the case is recrimped. **Caution:** *Always wear safety glasses when reloading.*

Naturally, before actually beginning to load, your reloading press will be mounted to the bench. Follow the manufacturer's instructions for this procedure. Most shotshell loading presses can be mounted with light $^{1}/_{4}$-inch mounting bolts. If the press is to be removed from the bench when not in use, wing nuts may make it easier to remove and replace the press.

That's all there is to reloading on a non-progressive press. It is easy to follow, and your ammo will bring a lot of satisfaction as well as save you money. However, at the risk of being redundant, you must read all of the material in this book before actually beginning to assemble ammunition. The remaining information is essential to safe and sane reloading.

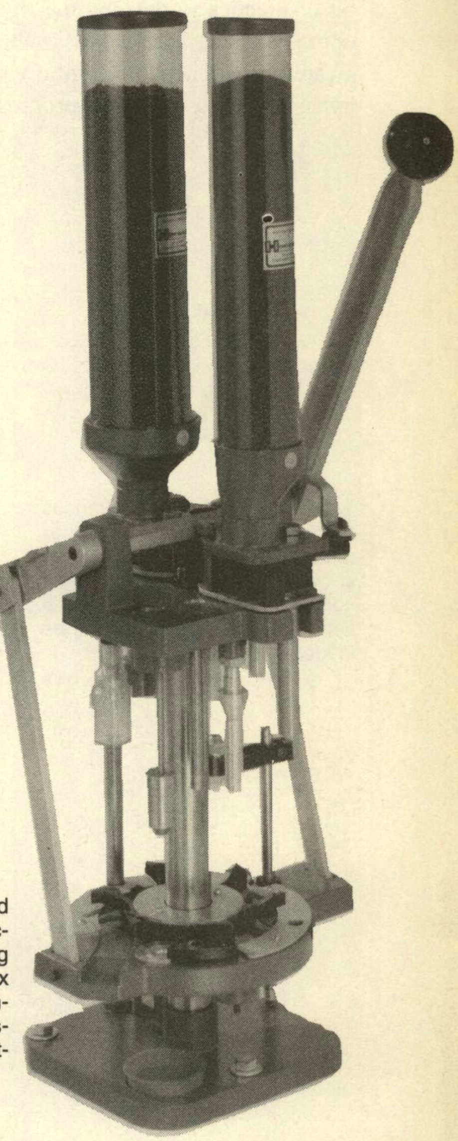
Inspect each case for its suitability for reuse and carefully segregate cases by types.

It is important to double-check and verify the components purchased with the components specified in the load data prior to beginning the reloading operation.



CHAPTER 4

Step-By-Step Reloading On A Progressive Press



Progressive presses can add a great deal of extra production capability to the loading process. The Hornady Apex can be used as a basic non-progressive press, a progressive press, or a fully automated progressive press.

A PROGRESSIVE PRESS is not generally the ideal selection for the beginning reloader, at least in my opinion. It operates at a much higher rate of speed with most all steps automated. There are six or more cases being reworked at one time and, if one does not have a full understanding of the loading sequences, or has not learned to recognize problems, a progressive tool can, at times, become frustrating. However, after having learned to load on a non-progressive press and having arrived at a point where high production rates are essential, a progressive may be a wise decision.

One drawback to many progressives is limited die adjustments. Most presses I have used are ideal for the majority of target loads in popular hulls, but are less than perfect for unique hunting loads where wad pressure and crimp die adjustments vary considerably.

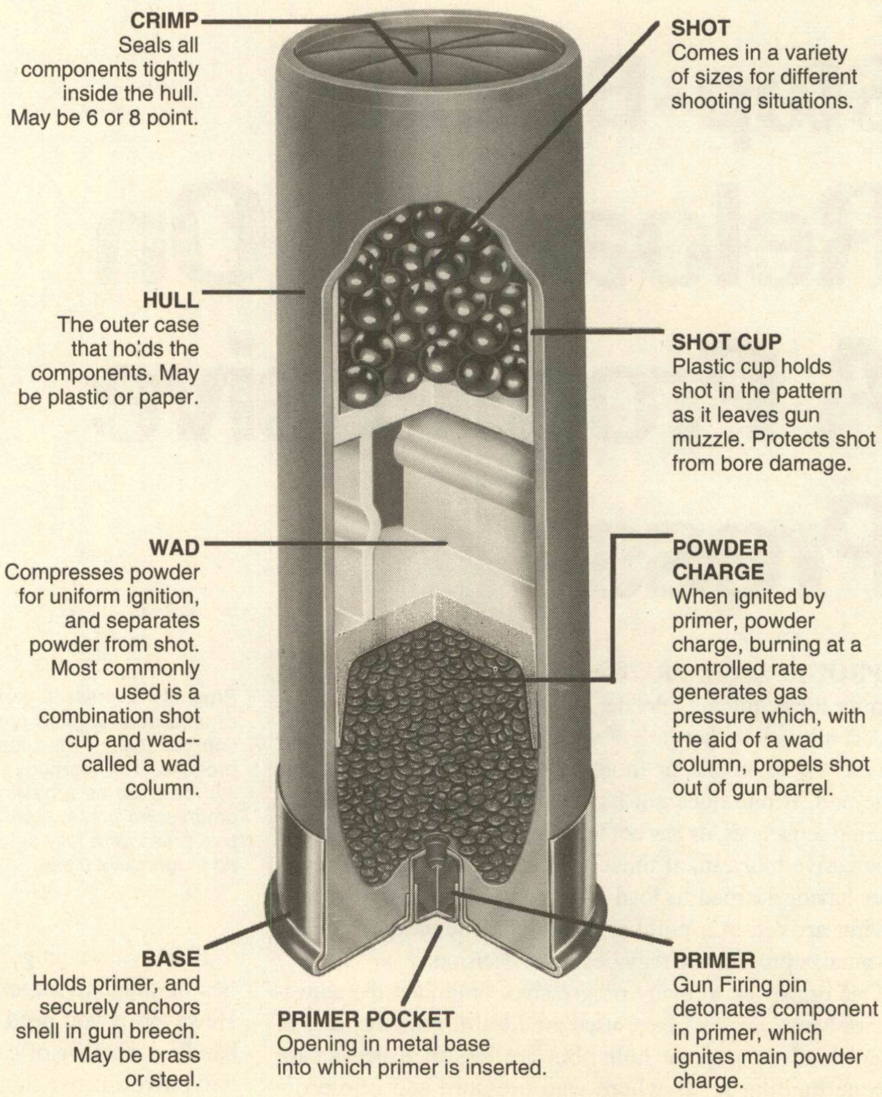
If you view a progressive tool as one to reload large quantities of standard target loads, you will not be disappointed. However, if you need load versatility or a machine that can handle a number of case styles, then a non-progressive tool will prove a better choice. The moral here is, do not get rid of your basic tool when purchasing a progressive unit.

Progressive presses produce a loaded round for each full stroke of the press handle. At one end of the progressive press spectrum are the semi-progressives where the operator inserts a fired case, primer and wad, pulls the press handle down, operates the powder and shot metering bar, moves the press handle up, indexes the shell plate, and removes a loaded round. The actual operation goes almost as fast as the telling.

At the faster end of the spectrum are the fully automated progressives that only require the reloader to insert a fired case and a wad, stroke the press handle up and down, and then remove a loaded round. Primer feeding, powder and shot metering, as well as shell plate indexing are all done automatically.

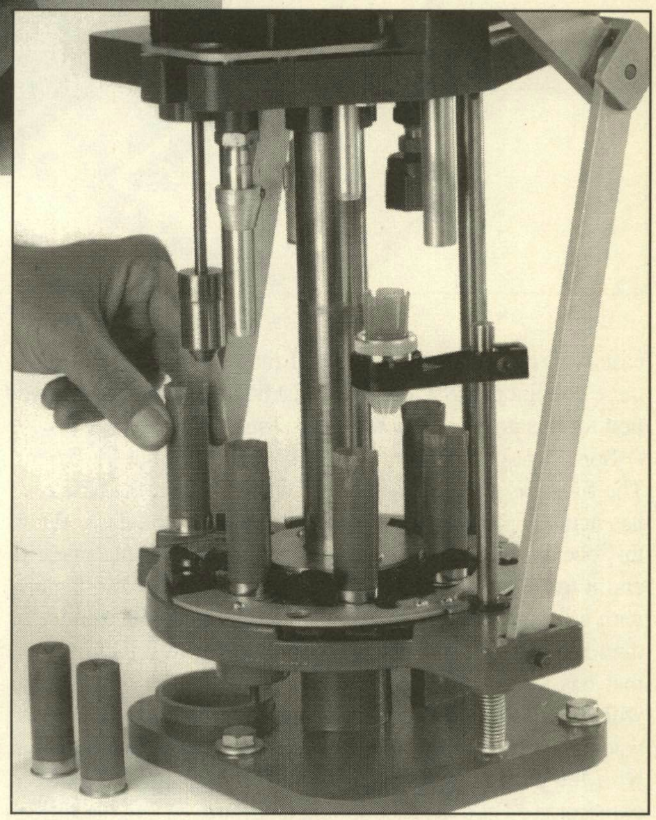
The reloader who is first graduating to a progressive press often does best without all of the automatic features. It takes a bit of practice to develop the rhythm or cadence needed to operate a progressive press while still maintaining a full awareness of each function at each die station. Those who bypass loading on a non-progressive press often find that ruined cases, spilled powder or shot jamming the machine, and other problems suddenly become commonplace.

The Hornady Apex shotshell reloader, which we are using here as our demonstration press, is a comparatively new tool with the unique ability to be used as a non-progressive loading tool, or as a semi-progressive feed-each-component-and-manually-index-the-shell-plate press, and finally, as an all-automatic-except-case-and-wad-feeding type machine. This unique versatility stems from add-on accessories that upgrade the Apex Standard to an Apex Automatic. Of course, the tool can be purchased either way. Because of the this, the Apex was chosen to demonstrate reloading on a progressive press. For our purposes, it will be used in the feed-each-component-and-manually-index-the-shell-plate format. To move to the automatic mode, the reloader need simply to follow the manufacturer's instructions. To use the tool as a basic tool, simply move one shell around the die stations until it is fully loaded. The actual process will vary slightly from press model to press model, but the basics will remain the same. Thus, under-



This cutaway shows the various components that the reloader must assemble into the fired shotshell case. Only the exact components and quantity specified in the data recipe should be loaded.

Properly inspect and segregate fired cases prior to reloading.



The Apex in the normal sequencee of progressive reloading will have six cases in the shell plate at all times.

standing the following material will prove useful for the operation of any progressive loading tool.

Case Selection, Segregation and Inspection

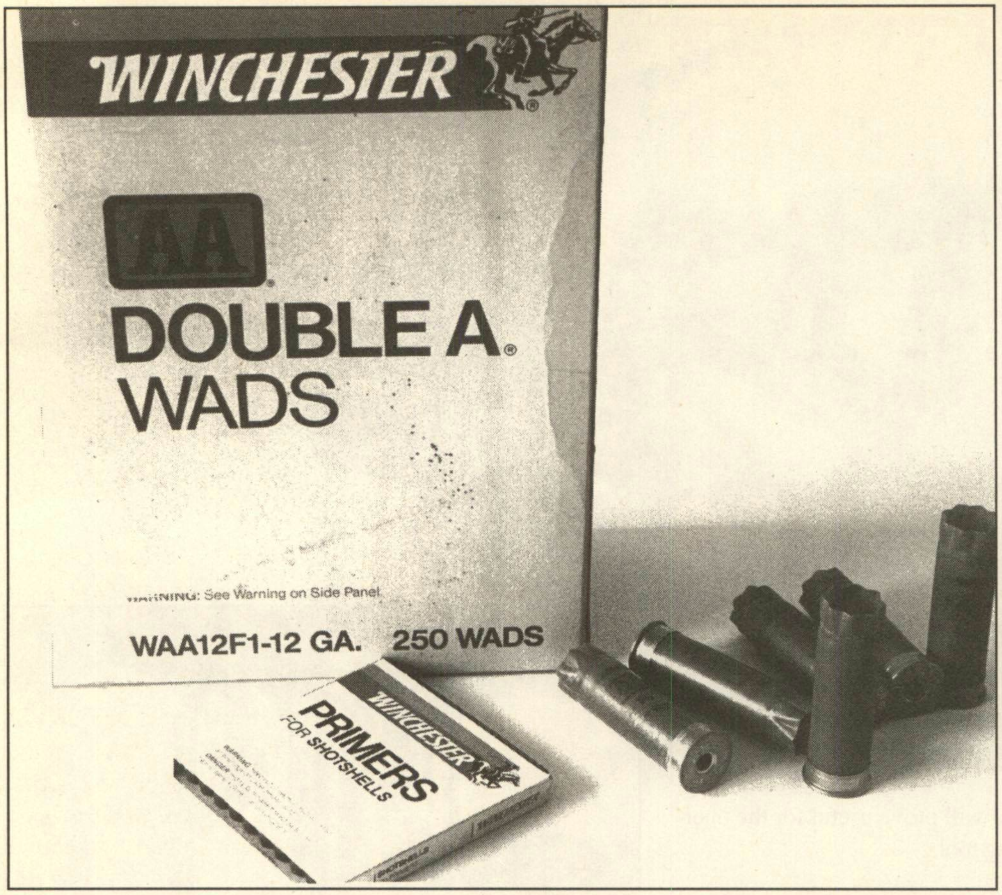
Cases should only be collected after firing factory ammunition in your shotgun, never from general range pick up. Cases lying on the ground at the range may not have been picked up for good reason. They have been fired many times and show signs of deterioration or damage not readily apparent to the novice.

Always carefully segregate cases into distinctive types. Not all shells of a given gauge use the same loading data, just like not all 30-caliber rifle cartridges use the same loading data. For example, the data for safely loading a 12-gauge plastic compression-formed Winchester AA case varies distinctly from the data for a Winchester or Federal Riefenhauser case. This is the same as a 30-caliber 308 Winchester case requiring different loads than a 30-caliber 30-06 Springfield case. Indeed, just as the 30-06 data would be dangerous in the 308, it is equally dangerous to use the data for a Riefenhauser-style case in a compression-formed case.

Also some types of cases such as the Reifenhauser can be fired only three times, whereas others like the Winchester one-piece plastic case may be suitable for a half-dozen firings. The reloader must learn to recognize cases that have even subtle differences and then to segregate them into individual lots.

After segregation, examine each case for defects. Discard any case showing even small signs of failure—burned crimp area; splits in the crimp area, case mouth or case body; burn-through holes on the case; and any distortion or damage to the case heads or body. Any visual defect is cause for rejection. If in doubt, throw it out! Also invert every case, ensuring no foreign matter is inside. Visually inspect and clean out the inside of each case before accepting it.

For cases of the Reifenhauser type, or paper-bodied cases, pay particular attention to the base wads which deteriorate with each firing, depending upon the exact load fired in the case. The base wads may be made from moulded plastic, tightly wound paper or other material. When the shell is fired, some gas may get between the obturating lip of the base wad and the case wall, forcing a gap to form between the wad and

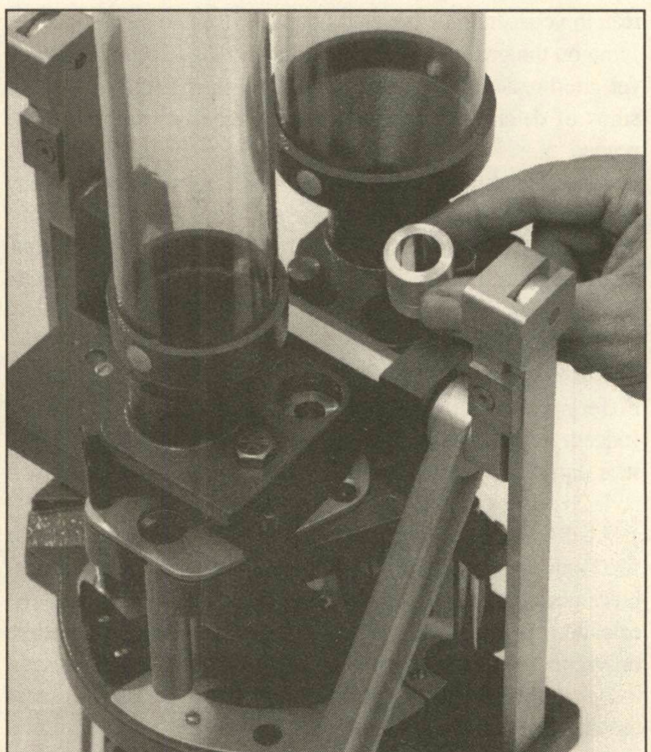


Make the appropriate component selections and confirm them by cross-referencing the load to a second data source.

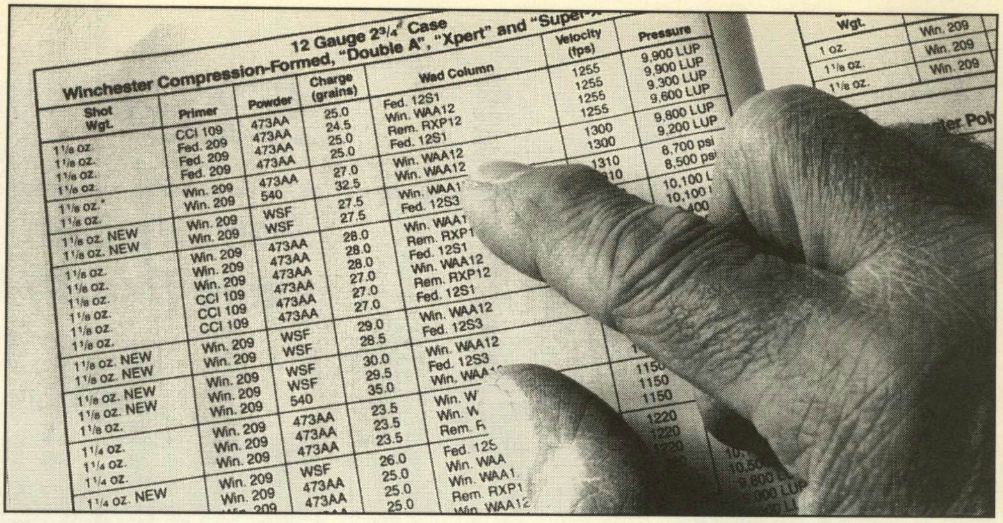
case wall or bits of the base wad may break off or burn. If these conditions exist, the case must be discarded. The inspection for this problem must be done visually.

Sometimes, however, visual inspection is not sufficient. The fired cases may look normal when, in fact, the base wad has actually loosened and moved forward in the case. When this occurs, the case represents a serious risk to the reloader and it must be discarded. Inspection for this problem is done with a dowel rod. Using a dowel of slightly smaller diameter than the case mouth, insert it into a once-fired factory load that has no deterioration. Make a mark on the dowel flush with the case mouth while the dowel is firmly against the base wad. If, when inspecting other cases, this mark does not align with the case mouth, the base wad/case integrity has been compromised and the case should be destroyed and discarded.

Because of all the extra inspection and possible dangers required when reloading these cases, it is strongly recommended the reloader assemble ammunition only with one-piece cases such as the Winchester compression-formed AA, Remington RXP or Federal Gold Medal types. Only the most experienced and knowledgeable reloaders should attempt to use non-unibody cases. Even then, never fire a case having a separate base wad more than three times. This means the original factory load firing and two reload firings—but only if case inspection reveals the case is suitable for each additional use. For more details on case segregation, inspection and other case information, refer to Chapter 6: Shotshell Cases, Selection and Identification.



Install the appropriate powder and shot bushings in the press. Actual metered charges must be verified prior to reloading.



Verify that the components you are about to use are indeed those specified in the chosen data.

Once all cases have been inspected and segregated by exact type you are ready to begin reloading a specific type case. Remember never load cases of differing types with the same recipe!

Component Selection

Component selection is based upon the specific recipe selected for the case in use. Refer to the reloading data section for the gauge; type of load (heavy field or magnum, field, light field, or target); shell length; and specific shell type for the corresponding primer, powder and wad needed. Make a note of these and purchase only the exact listed components. But, before actually purchasing any components be sure to read the chapters dealing with components.

Then, take along your reloading manual when shopping. If you are unable to locate one or more component items needed, you can look up another load for which you can obtain the needed primer, powder and wad. Do not let any salesperson tell you that one component can be substituted for another. (See the chapters dealing with specific components for the few rare occurrences of true interchangeability.)

With respect to shot, purchase the size you need based on your satisfaction with previously used factory loads or on information contained in the shot chapter. The various grades of shot (dropped or soft, poorest; chilled or hard, average; magnum or extra hard, best) will give patterns of varying density. For most applications chilled shot will be satisfactory.

Installing Proper Powder Bushing & Shot Bar

This is a vital step prior to the actual reloading process. Using the wrong shot bar or powder bushing can be extremely dangerous. First, carefully match the shot charge bar with the shot charge weight you wish to use. Then, install it on the press. Next, select the powder bushing listed for the propellant and charge weight you wish to load. Double-check the bushing as you install it into the machine. **Caution:** *The powder charge thrown by the powder bushing will not necessarily correspond to the charge listed in the manufacturer's bushing tables. The actual charge delivered may be lighter or heavier. It is essential you read Chapter 13: Shotshell Bars and Bushings, before beginning to reload ammunition.*

Component Verification

Take the can of propellant and the selected box of 100 primers from your remote storage area and place them on the loading bench along with the bag of wads and the shot. Open your data book and verify the load to be used. Double-check all the components you have placed on the bench to ensure they are what you must use.

Now double-check that the right powder bushing and shot bar are installed in the tool. Now fill the press shot and propellant containers. You are ready to begin the reloading process. **Caution:** *Never use a shot bar (or bushing) that is meant for steel shot when reloading with lead pellets. Equally, never load with a lead shot bar in place when using steel shot. Also never use lead shot data with steel shot. Likewise, never use steel shot data for lead pellets. Failure to follow these cautions can result in very dangerous pressure which could cause physical injury or death.*

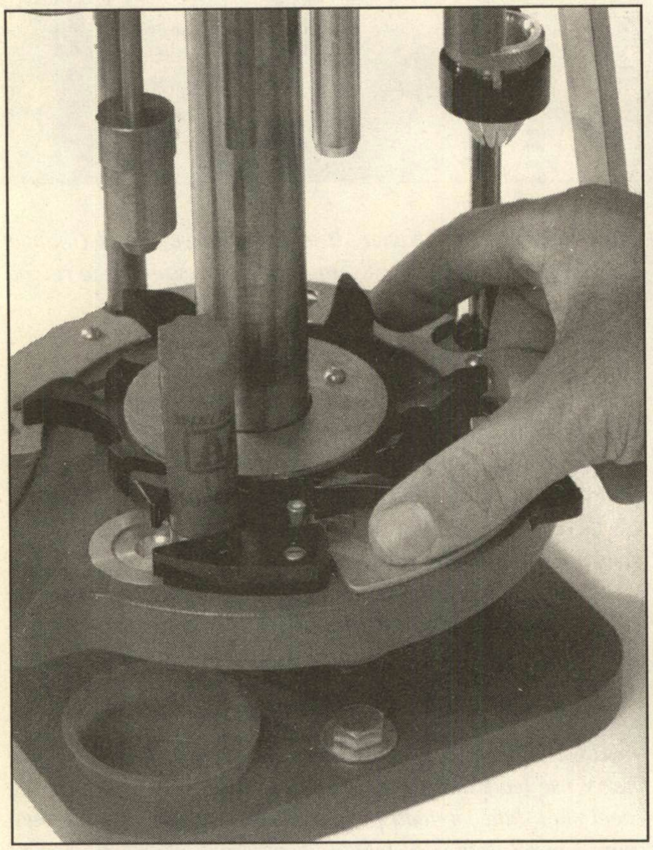
The photo of a cutaway shotshell shows the various components the reloader must replace. Naturally, the ejecta (propellant, wad, and shot) are all pushed from the cartridge case upon firing. (The powder is actually consumed and escapes as a very hot gas which pushes wad and shot from the barrel.) The case, which expands to approximately chamber diameter, must be resized to a smaller diameter to closely match the diameter of a new factory shell. The fired primer must be manually removed and replaced, Then propellant, wad and shot are added and the case is recrimped. **Caution:** *Always wear safety glasses when reloading.*

Naturally, before actually beginning to load, your reloading press will be mounted to the bench. Follow the manufacturer's instructions for this procedure. Most shotshell loading presses can be mounted with light ¼-inch mounting bolts. If the press is to be removed from the bench when not in use, wing nuts may make it easier to remove and replace the press. The actual procedure follows.

Take a moment to reflect on what you are about to under-

STEP 1

Decapping

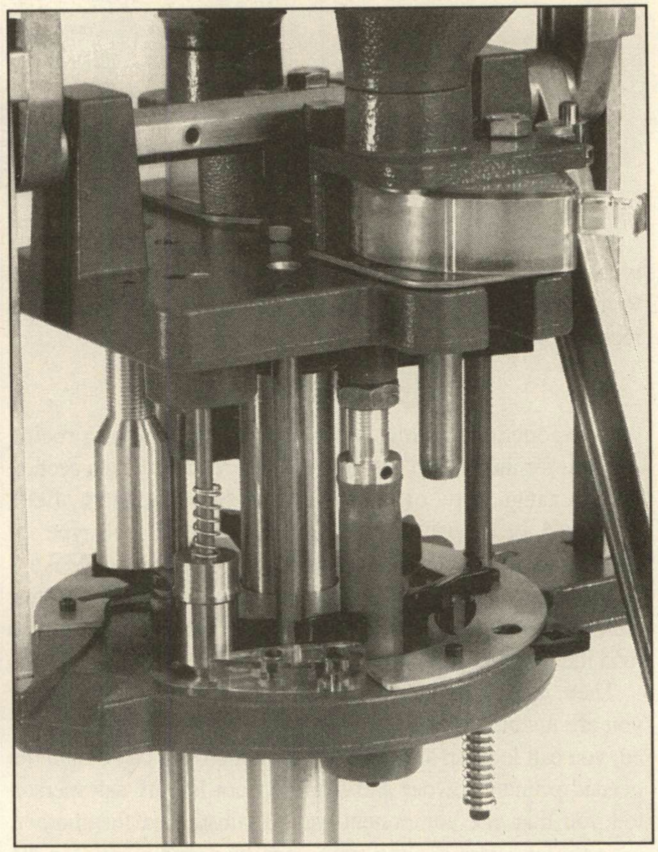


Important: The Apex Standard does not have provision for full-length resizing of the metal case head. If you must reload cases fired in a shotgun with a chamber larger than yours, you will need to process your cases through a separate resizing unit, or add an Apex collet sizing die (available as an accessory) to the press. The addition of the collet sizing die is strongly recommended.

With the left hand, pick up a fired case and, making sure it is free of foreign matter, slip it into the shell plate recess at the first station of the press. Pulling down on the press handle with the right hand removes the fired primer from the case. Keep the press handle in the down position and drop a new primer into the priming tube. Raising the press handle will drop the new primer into the priming station. Advance the shell plate one position with the right hand to move the deprimed case over the new primer. If you have installed the optional case resizing collet die, cases will be full-length resized at this point.

STEP 2

Priming and Case Mouth Flaring



Caution: *Always check to make sure there is no foreign material in the primer station before placing the primer into the primer tube. If a loose pellet or other material falls into the primer station, the primer could be ignited during seating and present a hazard to the reloader.*

Place a fired case into the first station. Pull down on the press handle and a primer will be seated in the case at the priming station (second station of tool). With the press handle still in the down position drop another primer into the priming tube. There is a learned "feel" to primer seating. The press handle needs to be lowered only until the primer's battery cup engages the mouth of the primer pocket. Excess pressure should be avoided. After a few practice rounds, you'll get to know the right "feel" of a properly seated primer. It should be just a hair lower than flush with the case head surface.

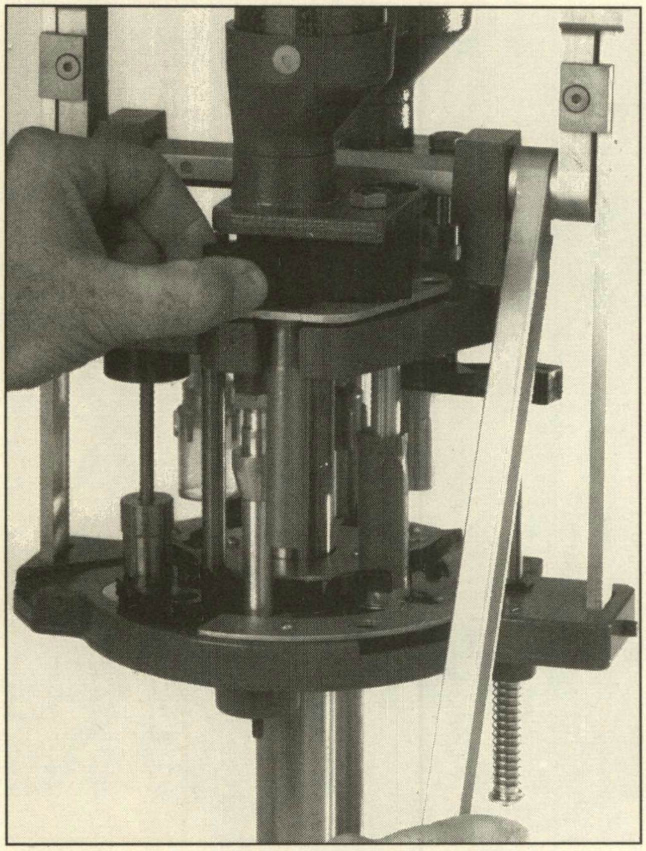
The case mouth crimp will be automatically opened up wide enough during the priming operation to allow a new wad to later be seated.

Now raise the press handle and advance the primed case to the third station on the tool.

Read the entire chapter before performing the sequence shown.

STEP 3

Powder Charging



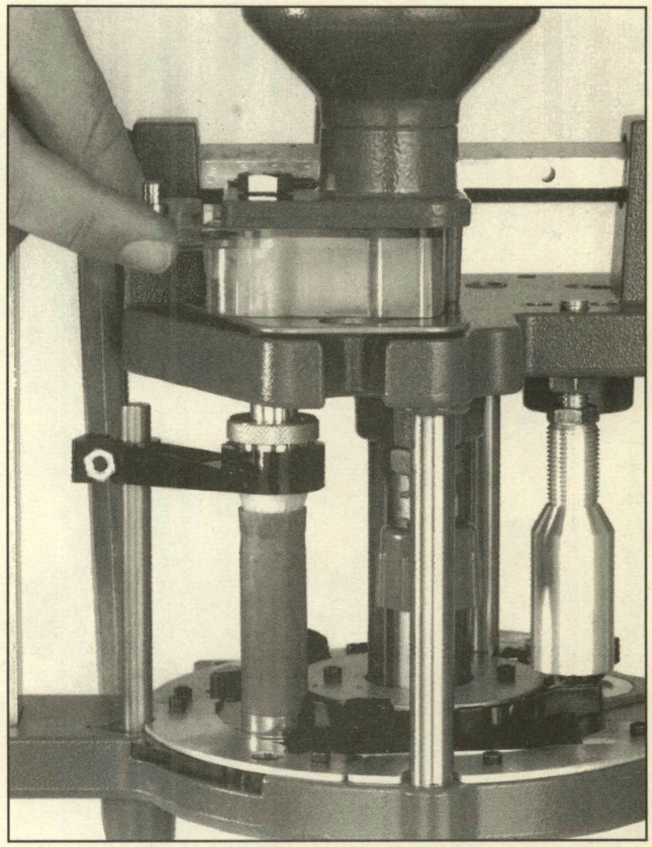
Caution: *The powder charge must be verified at the beginning of each loading session. The manner in which it is checked is critical and is covered in Chapter 13.*

Slip another case into the first station using the left hand. Now, pull the press handle down using the right hand and hold the handle in this position. Using the left hand, push the powder metering lever from right to left. This drops a powder charge into the case at station three. Now with the press handle still in the down position, drop another primer into the primer drop tube. Stroke the press handle fully upward and advance the shell plate to the next station.

When the press handle is pulled down, the other cases in the press will be decapped and primed.

STEP 4

Seating a Wad and Dropping the Shot



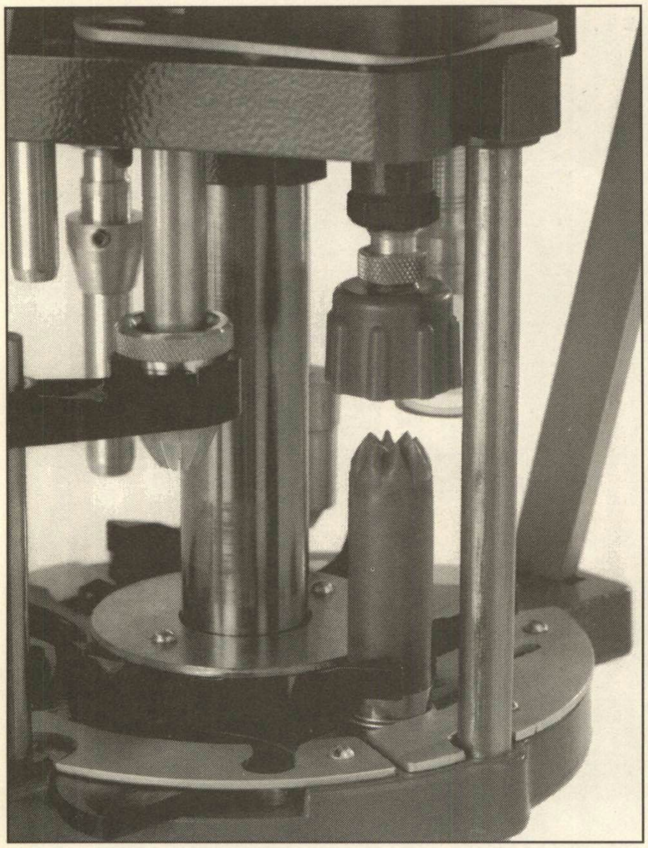
Pick up a wad with the right hand, and place it into the wad guide. Simultaneously place another shell into the first station of the tool with the left hand. Pull the press handle down using the right hand. This will seat the wad into position, deprime the case in station one and prime the case in station two. With the press handle down, meter the powder and shot levers and drop a new primer into the primer tube.

Raise the tool handle and advance the cases in the shell plate one position.

Read the entire chapter before performing the sequence shown.

STEP 5

Starting the Crimp

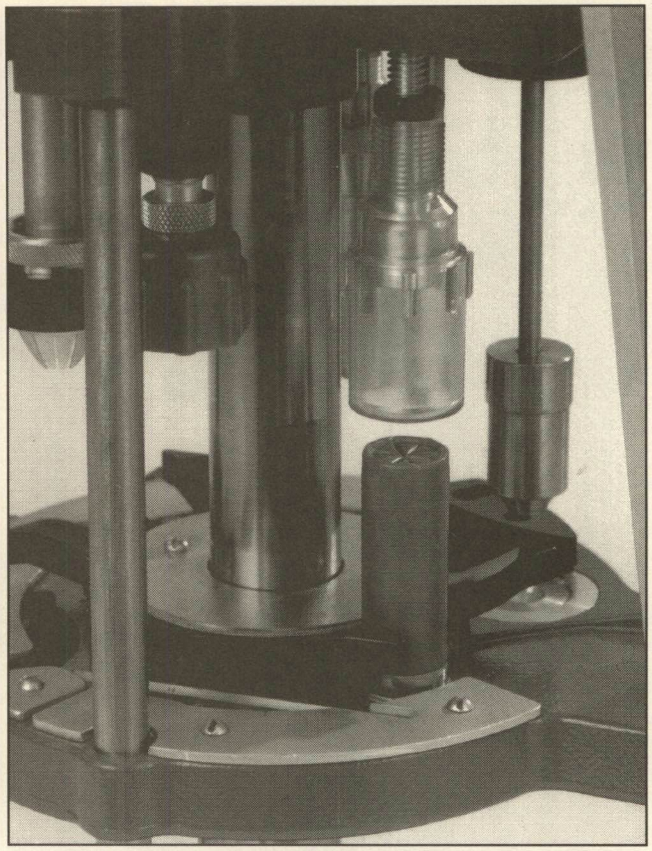


With the left hand, insert another shell into the first station of the tool and place another wad into the wad guide. You now have five shells in the shell plate. Pull the handle down with the right hand to form the crimp start. The crimp start die should be adjusted to close the case mouth at least two-thirds of the way. Normally, the proper adjustment for this tool will close the case about three-quarters of the way. With the press handle still down, drop another primer into the primer tube. Also meter the powder and shot charges. Then raise the press handle.

Note: The crimp start die must match the original factory crimp. For example a case that was originally loaded with a six-point crimp must be reloaded using a six-point crimp starter. Most factory target load cases have an eight-point crimp and therefore must be worked with a eight-point crimp starter.

STEP 6

Forming the Final Crimp



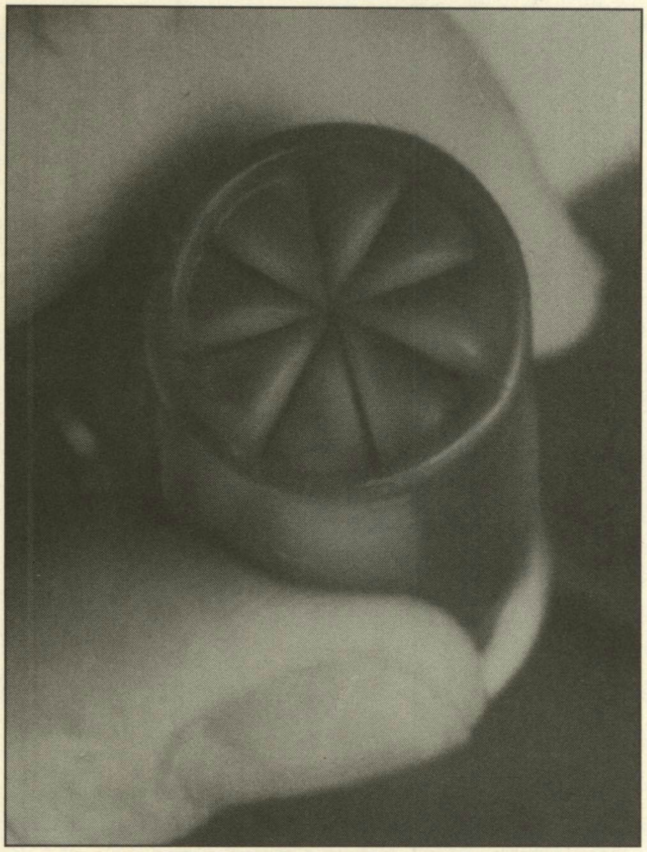
Place a wad into the wad guide and slide another shell into position at the first station of the press. Pull the press handle all of the way down and drop a primer into the primer tube and again meter the shot and powder charges. Raise the press handle and index the shell plate one position. The final crimp will now be formed. The finished crimp should look very similar in shape and depth to a factory load. If it does not, the crimping die needs adjustment. Follow the tool manufacturer's instructions to do so. Also read Chapter 11: Crimps And Ballistics.

At this point, the finished shell will be pushed from the shell plate. Remove it and begin the process all over. From now on, each full cycle of the loading handle will result in a finished round of ammunition.

Read the entire chapter before performing the sequence shown.

STEP 7

Final Inspection



After removing the loaded round from the press, carefully inspect it. Look for a poorly formed crimp, case mouth and body splits, bulges, improperly seated primer or any other reason to reject the shell. If the shell does not pass inspection, correct the problem and/or adjust the loading tool.

Caution: *Do not use any ammunition that does not pass your visual inspection. Discard all such ammunition in a safe manner.*

Read the entire chapter before performing the sequence shown.

take. It takes two hands to manipulate a progressive tool, and to keep things orderly. Some basics are appropriate. Your left hand will be used to insert a fired case into the shell plate, drop a primer into the primer tube, meter the powder and shot charge bar and remove the loaded round from the press. Thus, fired cases, primers, and a loaded round container should all be positioned on the bench to the left of the press.

The right hand will insert a wad into the swing-out wad guide, manipulate the press handle down and up, and advance the shell plate. Therefore, your wad supply should be placed to the right of the loading tool.

The loading process starts with the tool shell plate empty. You insert a case, perform the first step, advance the shell plate, insert a second case, perform two operations and so on, until the press has six cases in the shell plate—one positioned at each die station. After that you will need to simply keep feeding cases and components in order to obtain a fully loaded round for each down/up stroke of the press handle.

The loading sequence begins at the left front of the tool, progresses counter-clockwise, and the finished round is removed from the 9 o'clock (left side) position. But, for illustration clarity, several of the accompanying photos will show but a single shell in the press at the station being discussed.

Caution: *The following steps are basic procedures. They are not all inclusive of all the information required of the reloader. You must read all of the information in this manual, in your tool instructions, and as supplied by each of your component manufacturers before assembling any cartridges. If any doubt exists, contact the component or tool manufacturer for additional information as required.*

Automating The Loading Process

There are several add-on press accessories which convert the Apex Standard into a fully automated press.

- A collet case sizing die is available and recommended.
- A two-stage crimping die is an accessory for the Apex. This die will give a somewhat better crimp and provide additional flexibility.
- An automatic primer feed is also available as an upgrade. This unit will increase the speed of operation of the press.
- Automatic powder and shot drops are also possible with the addition of the appropriate accessory. Again, increased production will be had with the addition of this unit which also includes powder and shot detect safety rods.
- Finally an auto-indexing unit can be added to the Apex eliminating the need to advance the shell plate by hand.

That's all there is to the progressive loading procedure. It is not overly difficult to use a progressive tool if you remain alert. And your ammo production capability will bring a lot of satisfaction as well as save you money. However, at the risk of being redundant, you must read all of the material in this book before actually beginning to assemble ammunition. The remaining information is essential to safe and sane reloading.

CHAPTER 5

Step-By-Step Reloading On A Metallic Press

SHOTSHELL RELOADING IS generally done on a shotshell press, one suitable for no other purpose. And, usually undertaken by those who consume a great quantity of shotshells each year. Even modest efforts on most shotshell presses will yield the reloader 100 or more rounds per hour, and some progressives can easily raise the production rate to 250 shells per hour, even more.

But you may be one of the many other folks who would enjoy reloading shotshells though you have need for only a box or two of ammo at a time. If you are already into metallic cartridge reloading, you may be able to get started loading shotshells for only the price of a die set. However, your metallic cartridge press must have a $1^1/_4$ x 12 threaded bushing at the die station. The removal of this bushing (which accepts the standard $^7/_8$ x 14 metallic cartridge reloading dies) will allow you to screw in the larger diameter shotshell dies. Though not every metallic press is so equipped, a few popular presses are. The current examples are the RCBS RS-3, RS-5, RCBS Rockchucker and the RCBS AmmoMaster.

A few other presses like the Hollywood Senior or Old Western Scrounger Rock Crusher are made with a $1^1/_2$-inch bushing to accept shotshell dies of this diameter. Shotshell dies for these presses are still available from these manufacturers.

For our step-by-step instruction we will use the RCBS RS-3 press and the RCBS shotshell die kit. To get started, you need to first carefully remove the bushing from the press die station. If this bushing has never been removed, it may be very tightly in place. You will need to use a $1^1/_2$-inch hex-head socket wrench or a 15-inch adjustable wrench. Once removed, the bushing should go in and out of the press without undue difficulty. Because the bushing is quite thin, make sure the wrench fits well and work carefully to prevent it from slipping off the head under pressure, damaging the bushing or press or you.

Other items needed are a powder and shot scale, a powder funnel with $^3/_8$-inch pouring hole (a standard powder funnel can be drilled out), and a loading block. You should already have the scale and funnel if you are reloading metallic car-

A simple shotshell die set and a metallic cartridge reloading press are all that is needed to assemble limited quantities of shotshell ammunition. The shotshell die set from RCBS includes (counter-clockwise from left front): priming cup, wad guide, resizing die assembly with decap rod, crimp closer sleeve, shot dipper, shellholder, crimp starter, wad support guide, instruction booklet, drop/priming tube assembly, and final crimp bushing.

tridges. The loading block will need to be specifically for the shotshell gauge you are loading.

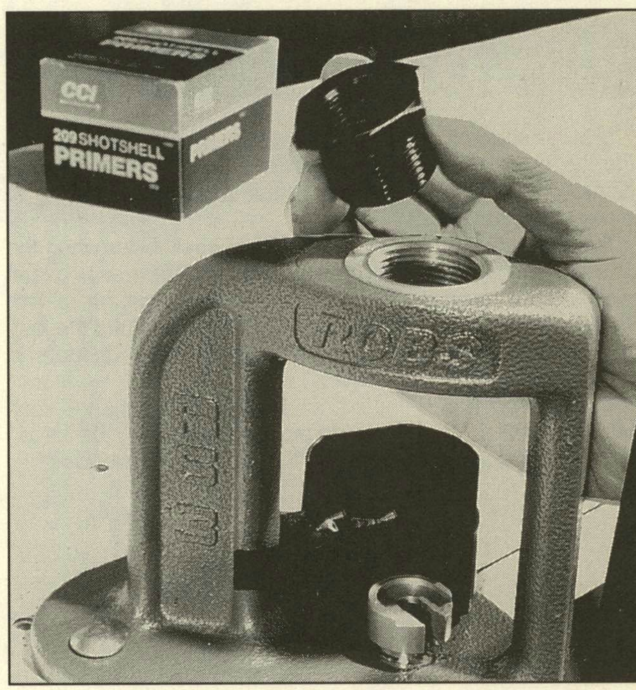
If you have a powder measure, the loading process can be speeded up a bit. However, a measure is not necessary as each charge of propellant may be weighed on your scale.

The RCBS shotshell loading dies have been designed to reload the most popular one-piece plastic cases such as the Winchester compression-formed AA, the Remington RXP, and the Federal Gold Medal. With a supply of these and two appropriate data sources, you will be ready to begin. Of course, you will need a quantity of primers, powder, wads and shot as specified in the loading data.

Case Selection, Segregation and Inspection

Winchester, Remington or Federal cases must invariably be obtained as a result of firing of factory ammunition in your shotgun, never as a result of general range pick up. Cases lying on the ground at the range may not have been picked up for good reason. They have been fired many times and show signs of deterioration or damage not readily apparent to the novice. Always carefully segregate cases into distinctive types. Not all shells of a given gauge use the same loading data, just like not all 25-caliber rifle cartridges use the same loading data.

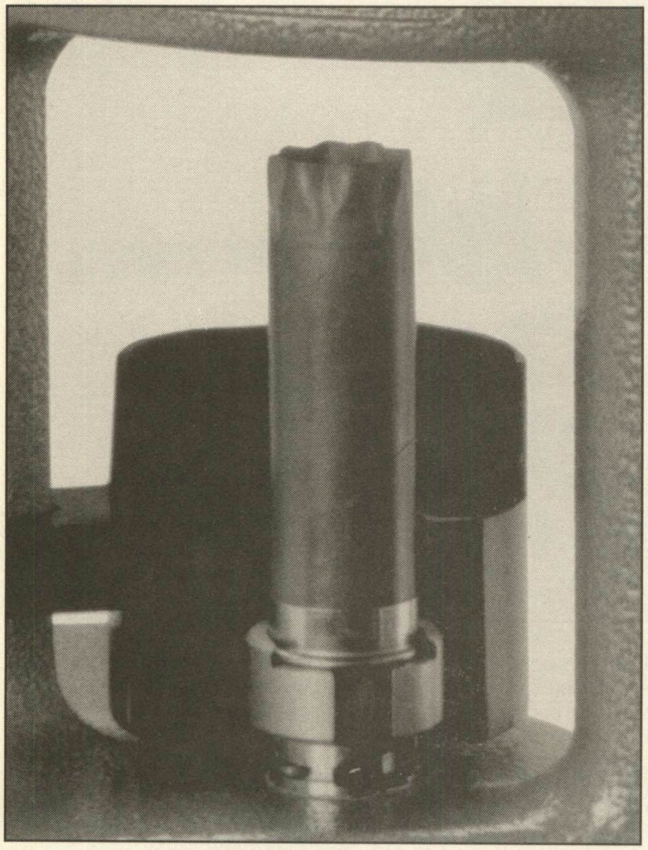
For example, the data for the safe loading of a 12-gauge



In order to load shotshell ammunition on a rifle/handgun reloading press, the press must have a removable $1^1/_4$" x 12 threaded bushing.

STEP 1

Installing Shellholder and Die Body In Press



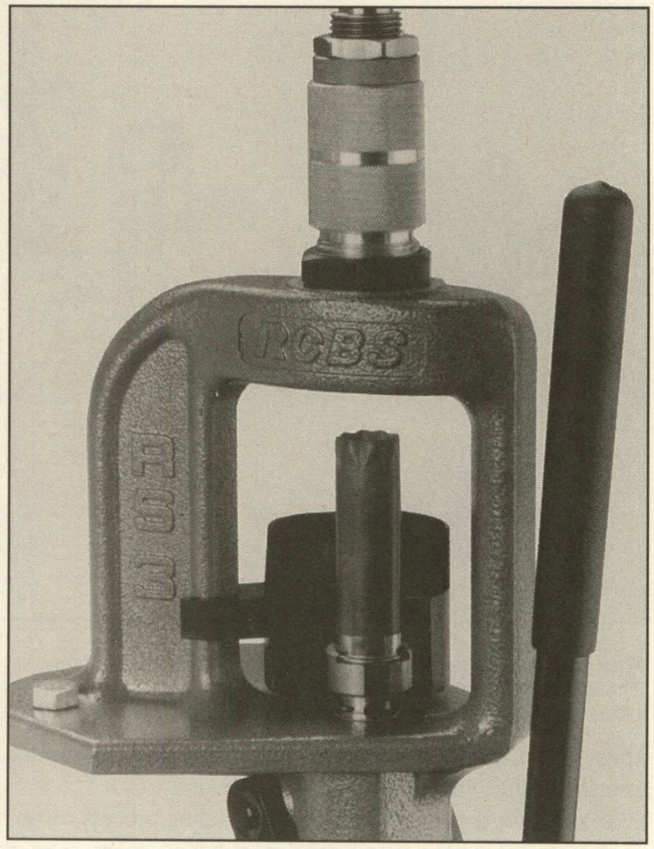
Slip the shellholder into the press ram. Screw the die body into the press and adjust it according to the manufacturer's instructions. The sizing ring and primer decapping rod must be assembled into the die.

The sizing die ring must just touch the shellholder when the press handle is moved its entire stroke. If the press "cams" over when it touches the shellholder, the die will be ruined. Shotshells require comparatively little sizing effort and the just-touching-the-shellholder adjustment will be fully adequate to accomplish the task.

The decapping rod should not protrude more than 3/8-inch below the sizing ring or the decapped primer may be forced into the ram slot and cause a jam that is difficult to clear.

STEP 2

Sizing and Primer Decapping



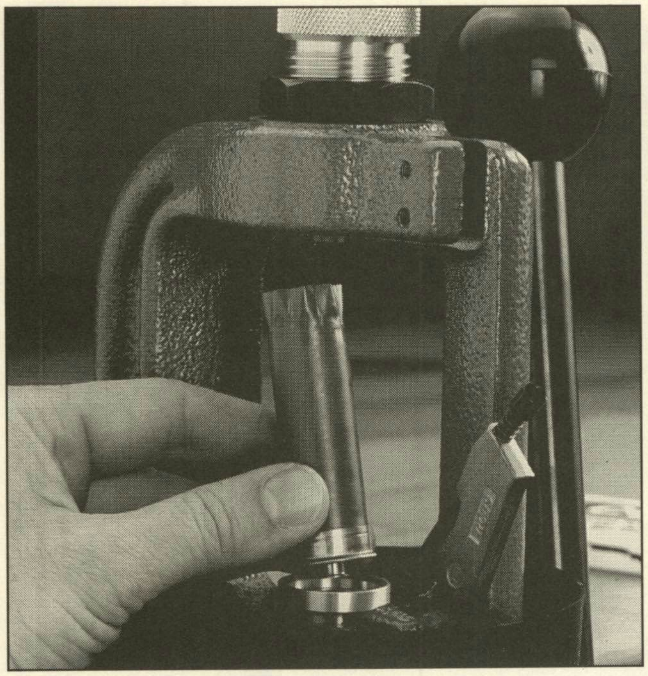
Now, process each case to be reloaded through the sizing/decapping die, placing them in the loading block as they are completed. Unlike metallic cartridge reloading, shotshell cases are not lubricated for sizing. All cases will be processed through each operation before proceeding to the next step.

Caution: *If you encounter shells that require undue resizing force, it may indicate cases that have been fired in a chamber larger than SAAMI specifications. Do not continue. Discard the entire lot as being oversized.*

Read the entire chapter before performing the sequence shown.

STEP 3

Repriming the Case



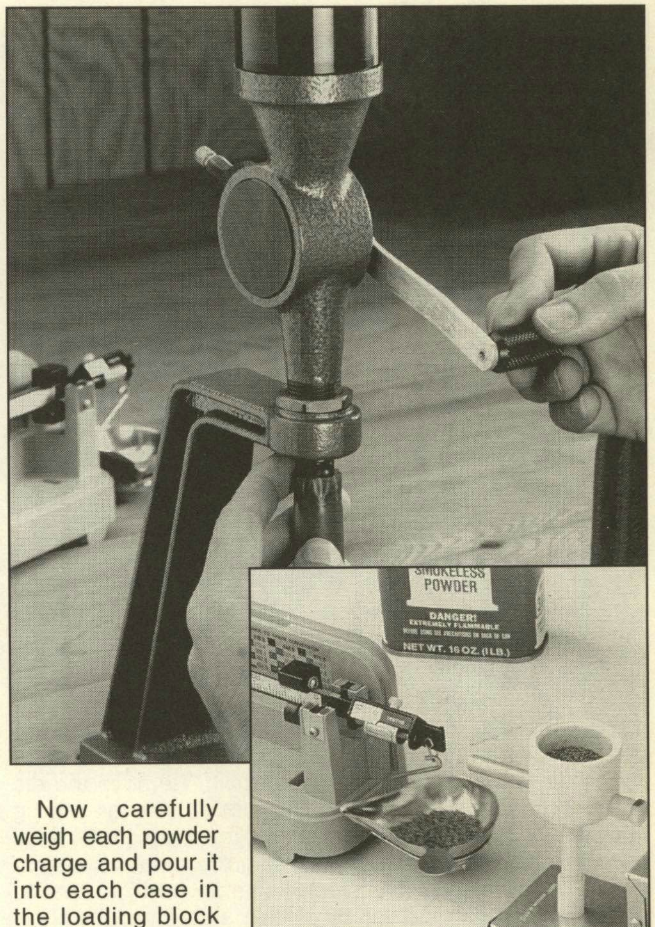
With all the shells to be reloaded properly decapped and sized, the die body must now be changed to a primer seating unit. Remove the top die bushing and decapping rod assembly. Drop the priming tube assembly into the die and replace the die bushing. Remove the standard shellholder and replace it with the priming cup. Remove the sizing ring to prevent cases from jamming in the die body during priming. The die is now ready for use.

Start by inserting a primer into the primer pocket of the case as far as it will go. Then place the shell onto the priming cup, and bring the press handle down to force the case into the die against the priming tube assembly. Do not apply excessive force. Simply seat the primer until the battery cup flange rests against the case head.

As with the other reloading methods, there is a learned "feel" to primer seating. The press handle needs to be lowered only until the primer's battery cup engages the mouth of the primer pocket. **Caution:** *Always make sure there is no foreign material in the primer cup before placing the primer/case into it. If a loose pellet or other material falls onto the raised portion of the primer cup, the primer could be ignited during seating.*

STEP 4

Powder Charging

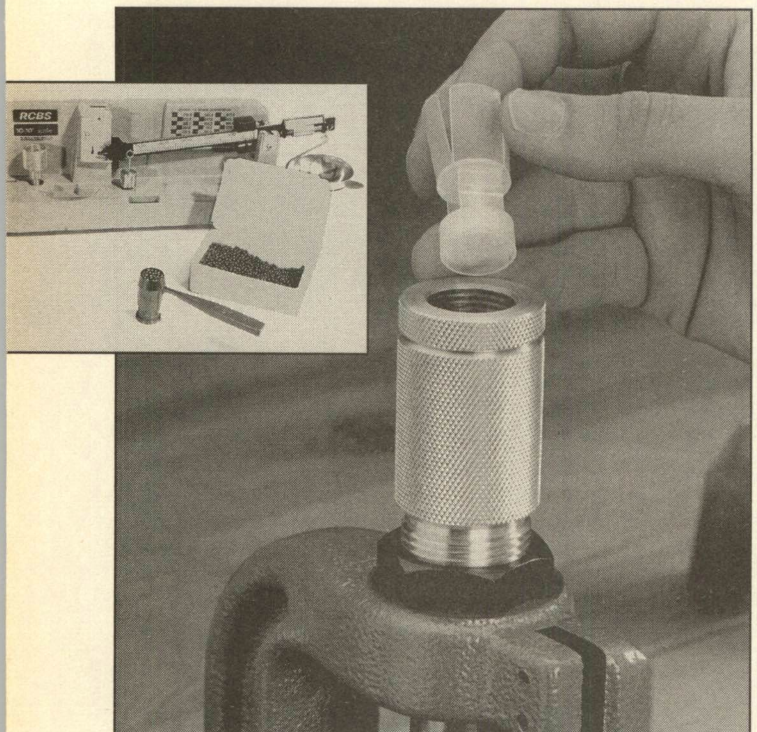


Now carefully weigh each powder charge and pour it into each case in the loading block using a funnel. When all cases are charged, visually inspect each to see that the powder level is the same height throughout. This safety procedure prevents double-charging. **Caution:** *If a powder measure is used for charging, the charge must be verified at the beginning of each loading session. Weigh the first ten charges thrown and record the weights to be sure the average does not exceed the specified charge weight. Also check that no individual charge exceeds the average nominal weight by more than 0.5-grain. If you cannot maintain the desired uniformity with your powder measure, weigh every charge.*

Read the entire chapter before performing the sequence shown.

STEP 5

Seating a Wad and Dropping the Shot



The die must be changed once again. Remove the die bushing and priming seating die unit. Also remove the priming cup from the press ram. Slip the shellholder into the ram. Next, assemble the wad guide into the wad guide support and drop both into the die body. Then replace the die bushing. Seating of the wad is accomplished by placing a shell into the shellholder and then running the shell up into the die. Next place the correct wad into the top of the die. Using the priming tube assembly, press the wad firmly down until it solidly bottoms on the powder charge. Do not remove the priming tube assembly from the case. **Note:** It is not possible to assemble loads requiring heavy wad pressure because the die can not be adjusted. It applies only a minimal amount of pressure.

After the wad is in place, insert the powder funnel into the priming tube. Now set the adjustable shot dipper, supplied with the die set, for the correct shot charge weight. **Caution:** *Verify that you are indeed scooping a shot charge of the correct weight by weighing a series of ten charges.* Scoop up a shot charge, being certain that the shot is level with the top of the scoop, and pour it into the case. Process all shells until each has a wad and shot. Then visually inspect each case to ensure a wad or shot charge has not been forgotten.

It is important to seat wads uniformly and to get consistent shot charge weights. Without these, crimps will not be uniform.

STEP 6

Starting the Crimp

There are three stages to forming a crimp on a metallic press. First, remove the die bushing, priming tube assembly and the wad guide and retainer from the die body. Insert the plastic crimp starter. Be certain the correct end of the starter (one end is for six-point crimp; the other for eight-point crimp) is facing down, Then replace the die bushing. **Note:** The crimp start die must match the original factory crimp. For example, a case that was originally loaded with a six-point crimp must be reloaded using a six-point crimp starter.

Slip each case into the shellholder and run it into the crimp starting die setup. The crimp start should be formed so that the case mouth is closed about one-half of the way.

STEP 7

Forming the Crimp

Remove all the crimp starting parts from the die body. Install the crimp closing sleeve, crimping spring, and the die bushing into the top of the die. Then screw in the crimp closing rod (the reverse end of the priming tube unit). Now process each case through the die. If crimps are not perfect, take time to adjust the die, and/or the crimp closing rod, up or down until all is satisfactory. Avoid open centers and cases that begin to buckle or rivet at the mouth. A bit of adjustment to the die will avoid both extremes.

Read the entire chapter before performing the sequence shown.

STEP 8

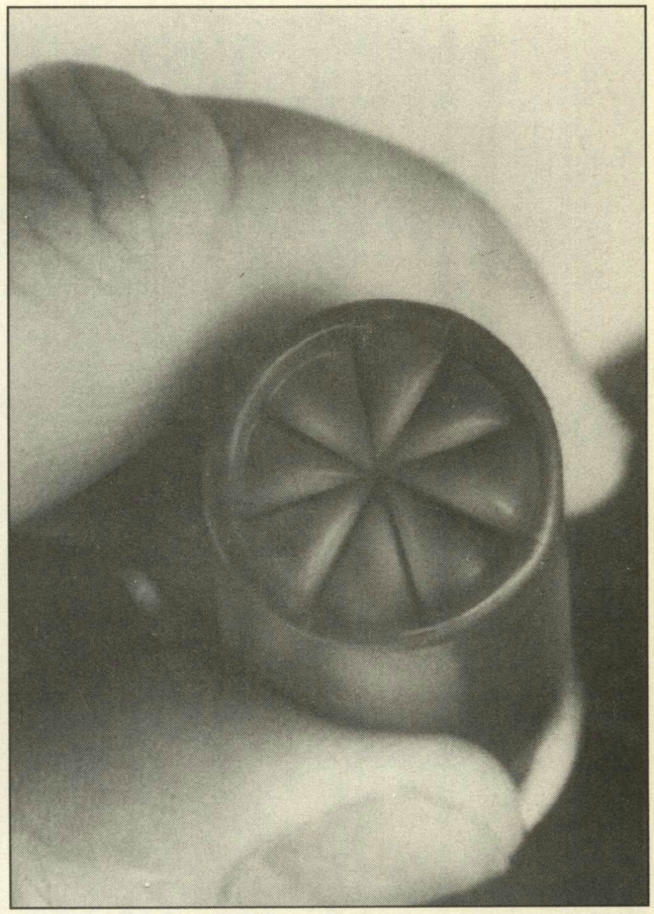
Final Crimp

The final crimp removes any slight riveting of the case mouth (which could cause feeding malfunctions and chambering difficulty) and puts a bevel on the crimp area to help firm it up. RCBS suggests this as an optional step, but we feel it is essential for top ammunition performance.

Strip the die body of all installed parts, drop in the final crimp bushing and screw in the die bushing. Run each case into the die to form a visible taper at the case mouth. Resistance will be felt at the top of the press stroke, but it should be slight, as the case is tapered. If the die is improperly adjusted, resistance will be greater and the case will buckle.

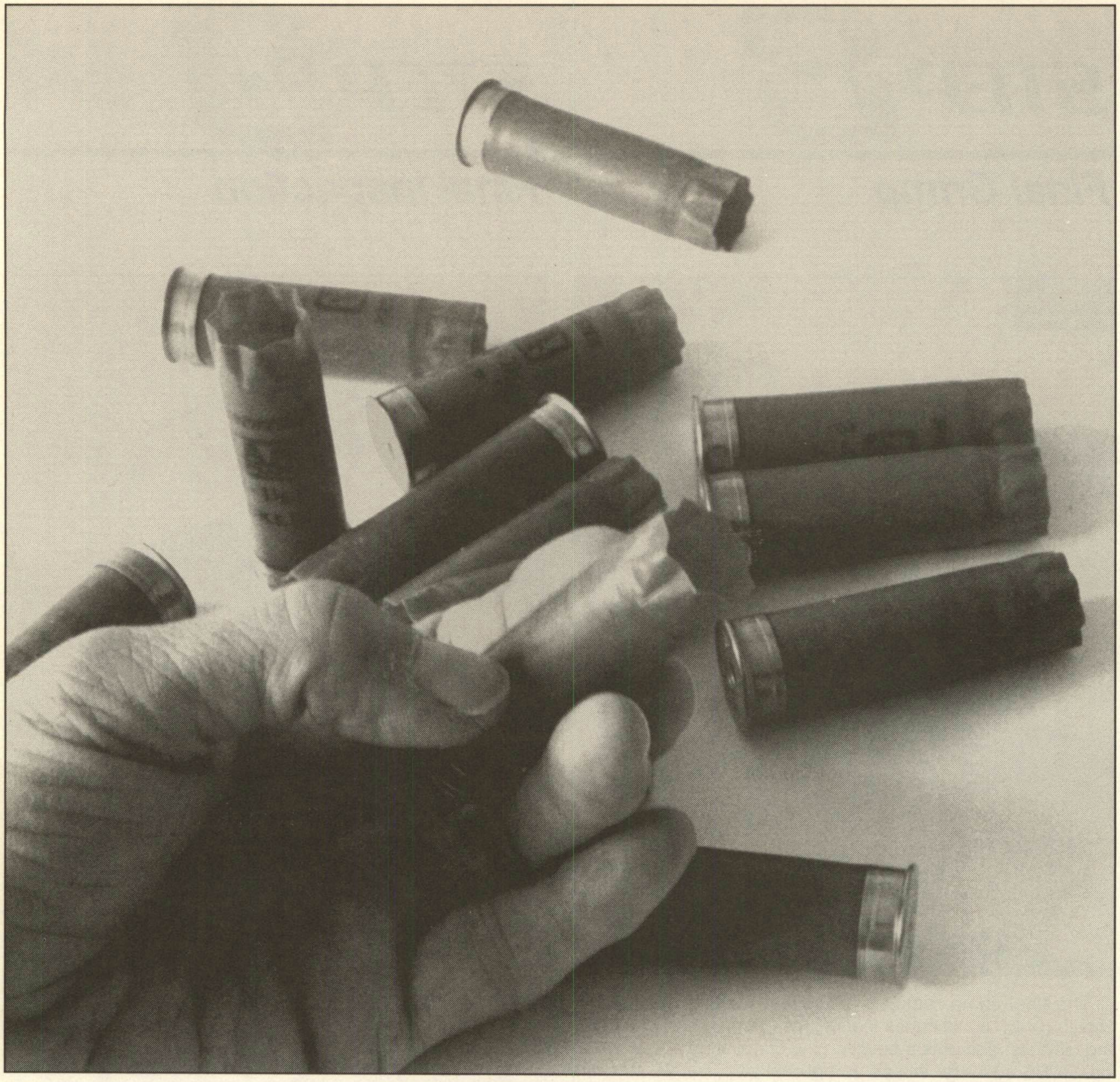
STEP 9

Final Inspection



Remove the loaded round from the reloading tool and carefully inspect it. Look for poorly formed crimps, case mouth and body splits, bulges, improperly seated primers or any other reason to reject the shell. **Caution:** *Do not use any ammunition that does not pass your visual inspection. Discard all such ammunition is a safe manner.*

Read the entire chapter before performing the sequence shown.



Inspect each case for its suitability for reuse and carefully segregate cases by type.

compression-formed Winchester AA case varies distinctly from the data for a Remington RXP or Federal Gold Medal case. While the variations among the three type cases are not great, they are, however, very important with respect to loading safe ammo at an anticipated level of ballistics.

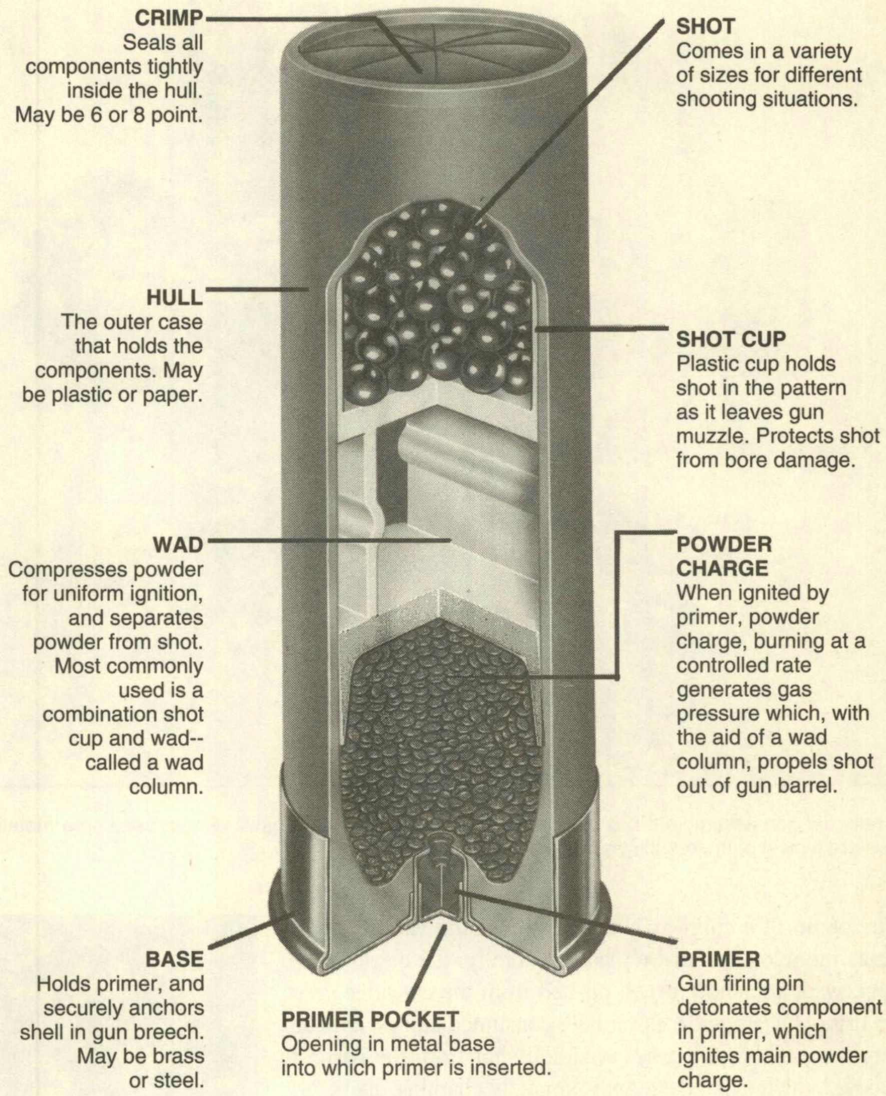
After segregating cases by type, examine each case for defects. Discard any case showing even small signs of failure—burned crimp area; splits in the crimp area or case mouth or case body; burn-through holes on the case; distortion or damage to the case head or body. Any visual defect is cause for rejection. If in doubt, throw it out! Also invert every case, ensuring no foreign matter is inside. Visually inspect and clean out the inside of each case before accepting it for reloading.

Once all cases have been inspected and segregated, you are ready to begin reloading. Remember never load cases of differing types with the same recipe!

Component Selection

Component selection is based upon the specific recipe selected for the case in use. Refer to the reloading data section for the gauge; type of load (heavy field or magnum, field, light field, or target); shell length; and specific shell type for the corresponding primer, powder and wad needed. Make a note of these and purchase only the exact listed components. But, before actually purchasing any components, be sure to read the chapters dealing with components.

Then, take along your reloading manual when shopping. If you are unable to locate one or more component items needed, you can look up another load for which you can obtain the



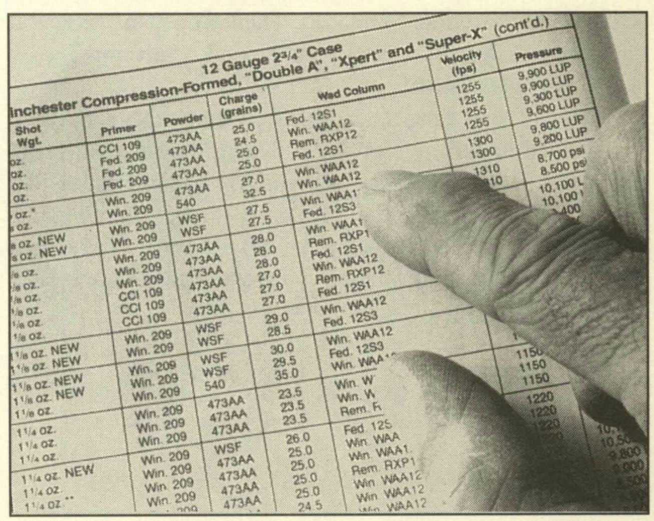
This cutaway shell shows the various components the reloader will replace during ammunition assembly.

needed primer, powder and wad. Do not let any salesperson tell you that one component can be substituted for another. (See the chapters dealing with specific components for the few rare occurrences of true interchangeability.)

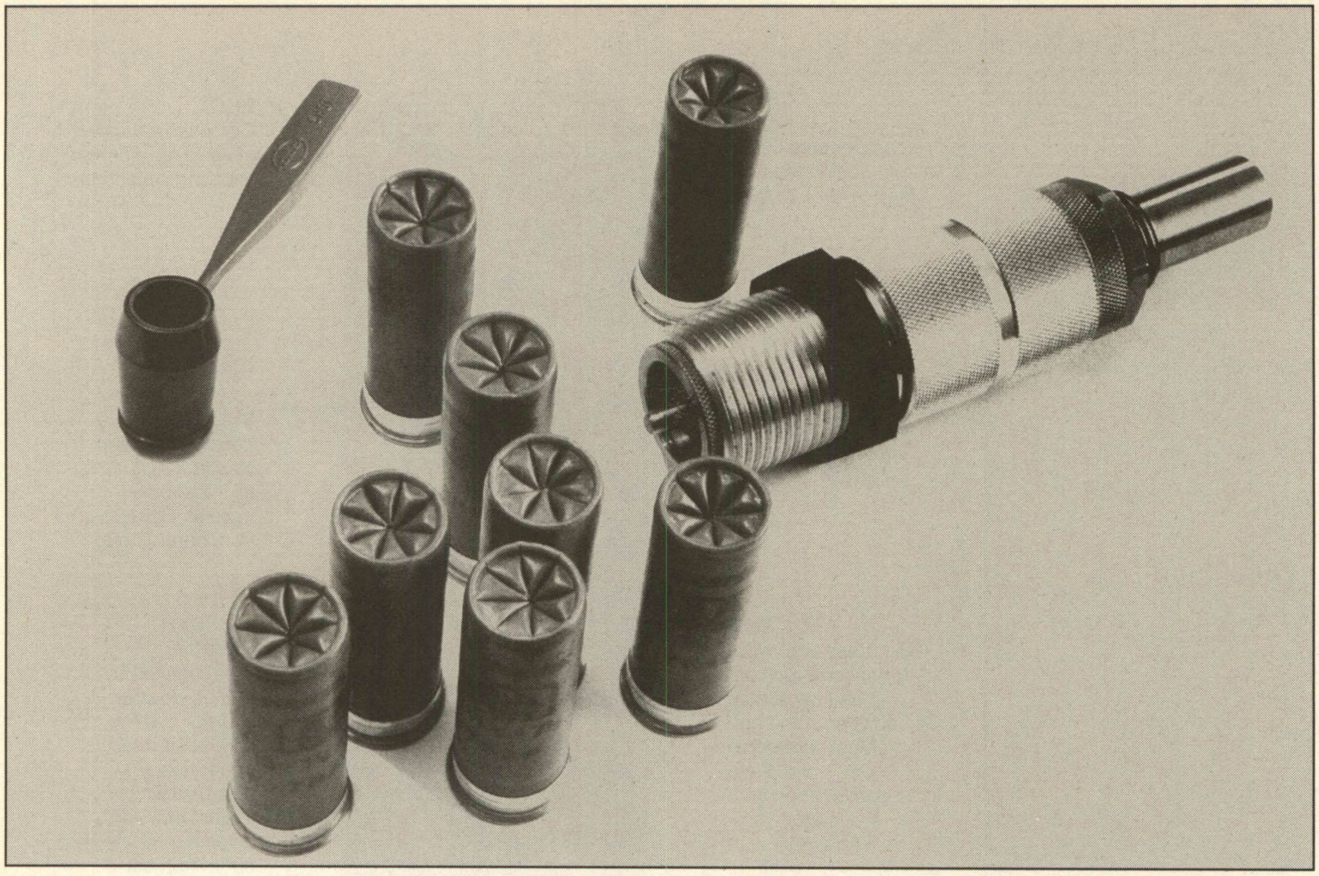
With respect to shot, purchase the size you need based on your satisfaction with previously used factory loads or on information contained in the shot chapter. The various grades of shot (dropped or soft, poorest; chilled or hard, average; magnum or extra hard, best) will give patterns of varying density. For most applications chilled shot will be satisfactory.

Component Verification

Take the can of propellant and the selected box of 100 primers from your remote storage area and place them on the loading bench along with the bag of wads and the shot. Open your data book and verify the load to be used. Double-check all the components you have placed on the bench to ensure they are what you must use.



Verify that the components you are about to use are indeed those specified in the chosen data.



The reloader can assemble a box of shells in about an hour with a basic die set used on a metallic cartridge reloading press. The crimps shown are typical of the results you will obtain.

The photo of a cutaway shotshell shows the various components the reloader must replace. Naturally, the ejecta (propellant, wad, and shot) are all pushed from the cartridge case upon firing. (The powder is actually consumed and escapes as a very hot gas which pushes wad and shot from the barrel.) The case, which expands to approximately chamber diameter, must be resized to a smaller diameter to closely match the diameter of a new factory shell. The fired primer must be manually removed and replaced, Then propellant, wad and shot are added and the case is recrimped. **Caution:** *Always wear safety glasses when reloading.*

That's all there is to the shotshell loading procedure using the a metallic cartridge press. Although slower than using automated tools, this ammo will perform just as well as that loaded on higher-production machines. Please read all of the material in this book before actually beginning to assemble ammunition. The information is essential to safe and sane reloading.

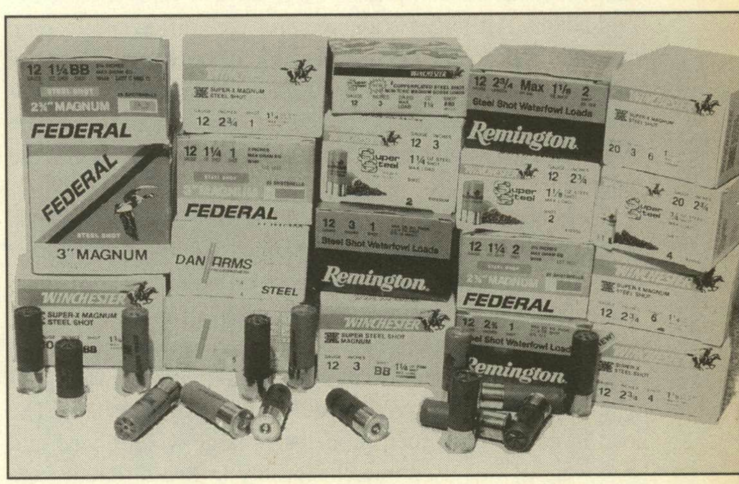
Select the exact components that are specified in the chosen reloading data. Never substitute one component for another.

CHAPTER 6

Shotshell Cases— Selection And Identification

SHOTSHELL CASES VARY. They vary by gauge and shell length; crimp style; and metal case head height; some have no metal head at all. They differ in construction with some basically a one-piece body (unibody) with or without a metal head; others an assembly of case tube and base wad with a metal head to hold it all together (Reifenhauser or polyformed). In some a plastic head and plastic body are welded together to form a unibody case and may or may not have a metal insert moulded into the case rim. Cases vary by color and by design; some being smooth sided, others having a ribbed tube. There are hulls with high inner base wads, low inner base wads and some with no base wad at all.

If a metallic reloader were to assemble ammo for a given caliber, it would be safe to say that all, say 30-06, cases are generally alike. Oh, one lot may vary ever so slightly from another, even to the point that a maximum powder charge might require some adjusting to keep ballistics constant. But, all in all, the cases are alike. In shotshell reloading, however,



Shotshell case variations are many. Gauge, length and brand differences are often obvious. But, inner construction variations in otherwise similar cases can demand notable variances in loading data.

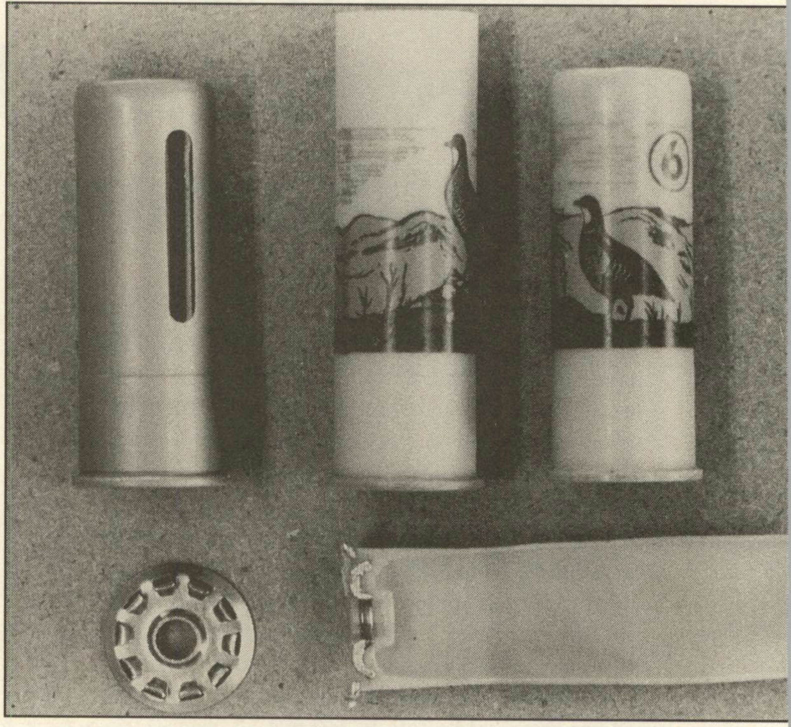
Even when cases are of the same gauge and length, the reloader needs to be cautious. There can be as much difference between loading data for two 12-gauge $2^3/_4$-inch cases of differing types as there is between two 30-caliber cartridges such as the 300 Savage and the 308 Winchester.

the cases of a given gauge vary as much in ballistic performance as they vary in brand, style and details of construction.

Of course, a $3^1/_2$-inch 12-gauge shell requires a drastically different load than a 3-inch shell, and both loads vary drastically from that for a $2^3/_4$-inch shell. This is easy to understand and accept. But there is a great deal more. For example, a 12-gauge Winchester compression-formed case (the type used to load factory AA target loads) requires very different reloading data than a Federal Reifenhauser case of the same gauge and length. In addition, this same 12-gauge Winchester compression-formed case requires equally different loading data than even another Winchester Reifenhauser case of the same length.

There are more than a dozen different 12-gauge $2^3/_4$-inch cases that come to mind; each requires specifically different data. In some instances, the data is so different that a safe load in one could be catastrophically dangerous in another.

It should be apparent that case differences with respect to ballistics can be enormous. In a recent court case, I was asked to testify as an expert on the safe reloading of shotshells. The load in question (primer, propellant/charge weight, wad and shot weight) was used interchangeably in two different style cases by a reloader. In one case type, the load produced very high pressures though not enough to be necessarily catastrophic. In the other, however, pressures were at levels equal



Cases can look different outwardly but be of identical construction internally and hence use identical data. The Activ cases at the extreme left and right are of this nature, having identical construction as shown in the cutaway view. The case in the middle is a new never-loaded component case.

to the upper range of proof rounds. The gun eventually failed due to the combined abuse of these loads and serious injuries were sustained by the shooter and a bystander.

Case Segregation By Type Is Essential

The shotshell reloader must learn to carefully segregate cases by specific types. And then each specific case type must be loaded only with data specifically published for it. It should never be assumed that because a bunch of cases are the same gauge, length, color and from the same manufacturer that the load for one will be safe in all the rest. Remember, sometimes the differences which cause ballistic changes are subtle (though admittedly sometimes they are not). It is the reloader's responsibility to make sure cases are properly segregated, not only by gauge and length but also by specific shell type. *We repeat not all cases of a given brand are the same type. If there is ever any doubt about case identification, contact the case manufacturer before beginning to reload.*

There are exceptions to this rule. Some cases which, at first glance, appear to be different because of metal case head height can and do use common data. One reason is that the outside height of the metallic head has no bearing on ballistic performance if everything else about the case is identical. For example, currently all 12-gauge $2^{3}/_{4}$-inch Winchester compression-formed cases are manufactured with identical body forms and dimensions, hence they will produce identical ballistics with a specific load. Included would be high brass head (Magnum and Super-X), low brass head (Super-X low brass or the older names of Upland and Xpert), and AA target cases (extra light, light and heavy). All would use the same data. The same would apply to this case style in other gauges or shell lengths.

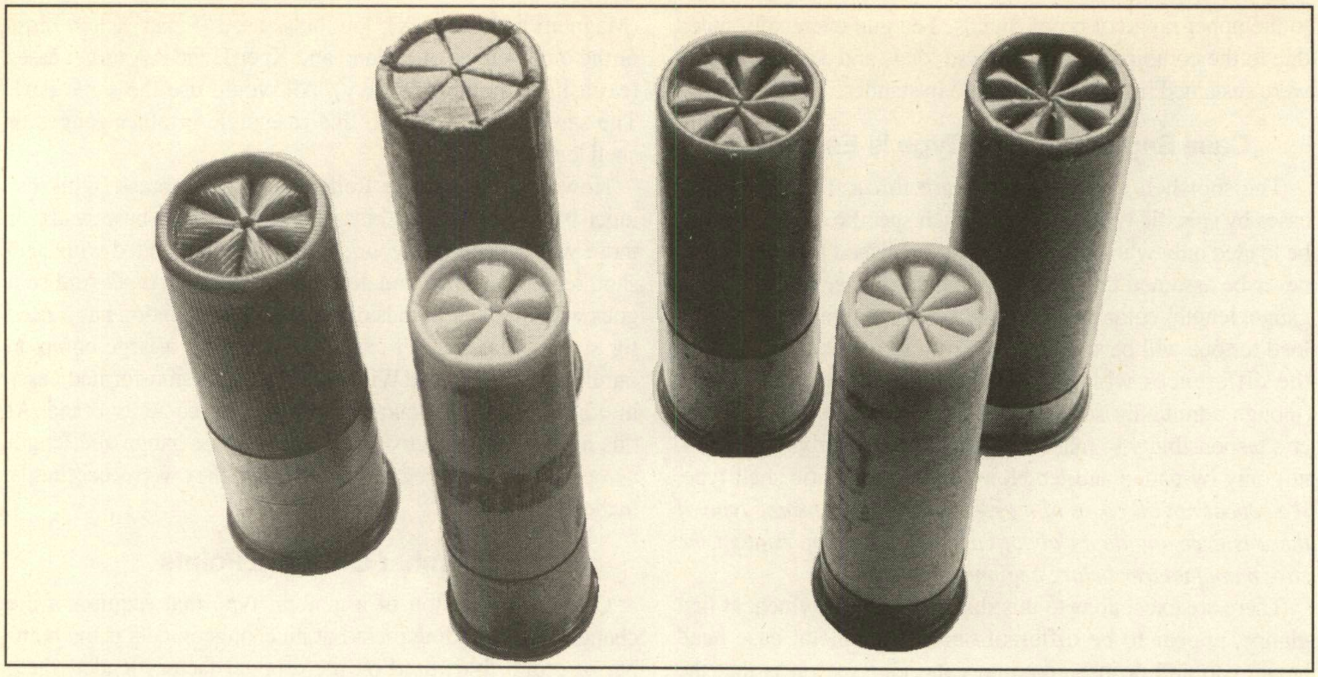
However, Winchester Reifenhauser high brass (with low inner base wad) or low brass (with high inner base wad), or those with a paper body, or shells originally loaded with steel shot, require separate and distinct data for each type. And so it goes with all other brands of cases. Every variation has a need for specific data. Don't expect to find such a large common family as cited for the Winchester compression-formed cases in other brands. One current exception is the Activ brand. At this point in time, Activ shells of the same gauge and length use common data regardless of how they were originally loaded.

Number Of Crimp Points

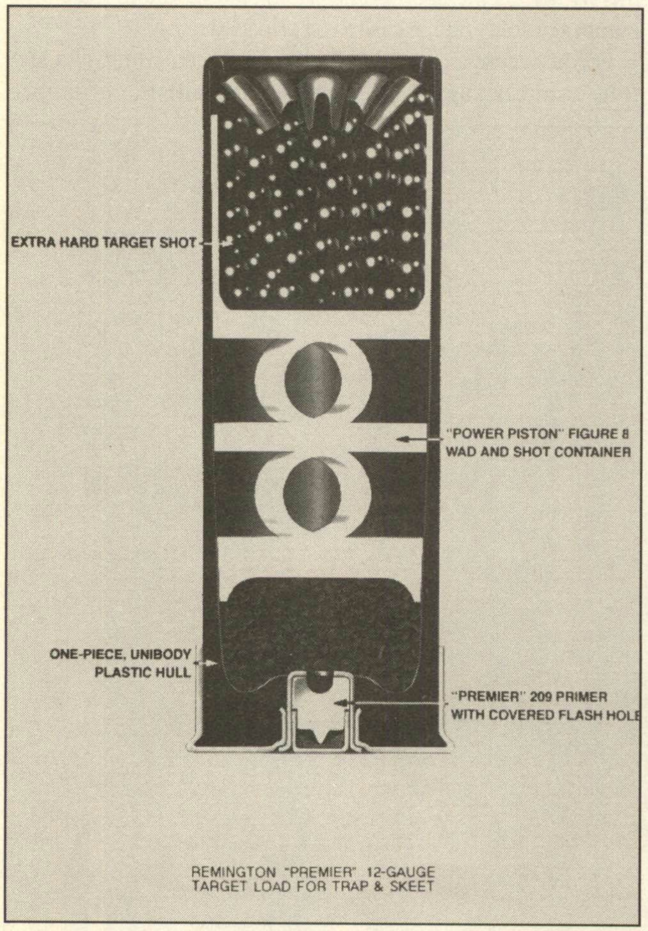
One case variation of a general type that requires a die change on the loading press but no change in data is the number of crimp folds used on the original factory-loaded shell. Factory folded crimps generally come in either eight-point or six-point styles. If all else on the case is the same, then one merely selects the appropriate crimp starting die to match the number of folds on the case to be reloaded.

For new cases, cases that have never been crimped, a six-fold crimp is suggested. There is no ballistic difference

These 12-gauge $2^{3}/_{4}$-inch cases are all Winchester compression-formed hulls and use identical loading data.



The number of folds (six or eight) in a case's crimp do not affect ballistics, though the appropriate crimp starter must be used when reloading.



Shotshell ballistics are built into the case. The type and quantity of components used, as well as case construction will determine the ballistic performance of the shell. The actual shotgun used will have little bearing on the load's performance.

between the two, but getting new cases to accept a good eight-point crimp can be somewhat difficult. The six-point will not test the reloader's patience as severely. This is especially true if the new cases do not incorporate inside tapering, or skiving, of the case mouth which thins the plastic in the crimp area.

Shotshell Ballistics Are Built Into The Shell

In metallic reloading, overall length of the loaded round as well as the dimensions of the chamber in which the cartridge is fired can alter ballistics substantially. Using the same basic loading data, it is possible for a shooter to assemble rifle or handgun ammunition that will produce velocities and/or pressures which vary greatly from published levels. I have conducted tests which showed as much as 5000 psi difference between rifle rounds. Additionally, metallic cartridge ammo from the same lot, when fired in different chambers, can produce notably different ballistics. Using ammo in two rifles of the same make, model and barrel length has created velocity changes of up to 200 fps.

This is not true of shotshell ammunition. The pressures generated upon firing a shotshell are pretty much built into the loaded round. Within the confines of industry acceptable chambers, the velocity and pressure will not vary notably from one shotgun to another when ammo from the same lot is used, assuming identical barrel lengths.

Worn Cases Affect Ballistics

The velocity and pressure generated with each firing of a reloaded shotshell case can vary. The metallic cartridge reloader will experience an increase in pressure with each firing of a given case due to neck thickening and case lengthening. But, shotshell ballistics normally decrease with each subsequent firing. Less falloff occurs with the first few firings,

Shells originally loaded as target rounds, such as these Winchester AA Skeet loads, make ideal candidates for reloading. Whether Federal, Remington, or Winchester brand, such cases assemble easily and there is plenty of data available for each type in each available gauge.

more with each additional firing.

With normal loads, this ballistic falloff can eventually lead to problems. In extreme instances, ballistics can become so substandard the reloader experiences punky sounding or squib loads. The problem is at its worst when slow-burning powders are used with relatively heavy loads. The falloff is caused by weakened plastic in the crimp area, the crimp no longer being able to offer sufficient resistance to the initial push of primary ignition. In short, the crimp opens too fast, allowing the "chamber area" to increase before the powder reaches proper combustion speed. Peak pressure is retarded and lowered ballistics result. This same problem can also occur with any load that develops relatively low chamber pressure—less than 7500 lup/8500 psi.

To avoid this situation, use only once-fired factory cases when loading with very slow burning powders, or when working with comparatively low chamber pressures. Save cases that have been fired numerous times for target loads which use the faster burning powders and generate chamber pressures in excess of 8500 lup/9500 psi.

Where To Start

So how is the beginning reloader to proceed without confusion and trouble? Actually it is quite simple. Purchase only one type of factory loaded shotshells. For example, use all Winchester AA target type shells or all Federal Gold Medal target or all Remington RXP. It doesn't matter if the shells were originally loaded with a 2¾ dram equivalent (light) or 3 dram equivalent (heavy) or one of the extra light target loads. Nor does it matter what size shot was in the original load. If you buy only one basic type of factory load, you will greatly simplify your first loading efforts.

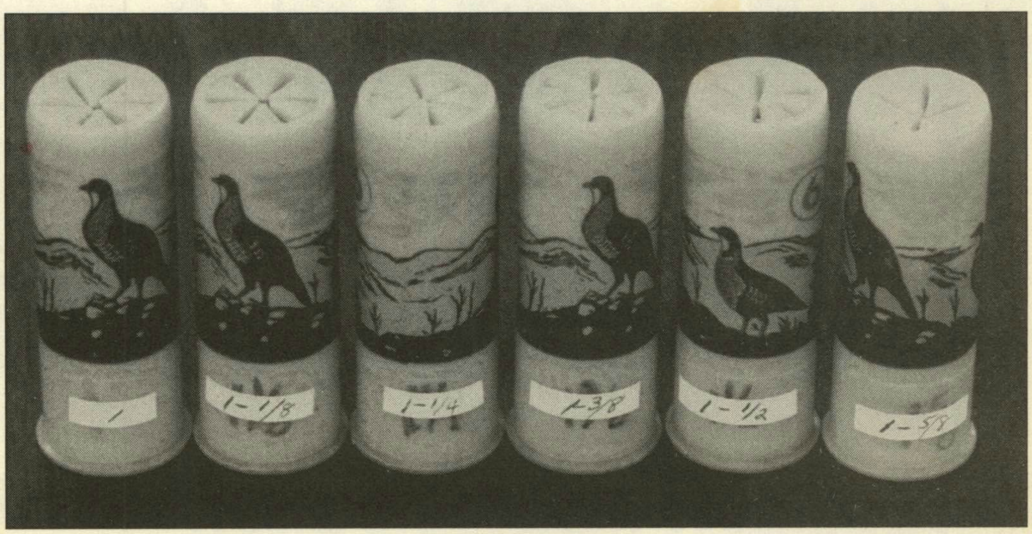
As you begin to recognize which cases are the same and which are different, you can then begin to reload various styles. Keep in mind though that a case style change may demand readjustment of the crimping dies. Since many factory shotshell presses come pre-adjusted for target-style cases and loads, it makes sense to begin with this type case and load.

Another point in favor of this approach is the relatively long reloading life of some target-type cases. Many shooters purchase a particular brand of target load based on the number of times a satisfactory reload can be assembled. For this reason, manufacturers often put their best engineering efforts into designing a target case that will give satisfactory multiple firings and which will recrimp nicely.

Loads To Be Assembled Versus Original Loading

It is not essential to duplicate the original factory load. You may load target cases with magnum loads or, inversely, use shot of a larger or smaller size or of a greater or lesser shot charge weight than the original. In short, you may assemble any load for which there is legitimate published data. The exceptions are cases originally loaded with a roll crimp. They

It is possible to assemble a wide range of loads in a given case type, regardless of the type load originally assembled into the case by the manufacturer. Each of these cases was loaded with a different primer, powder and wad. And each has a different size and weight of shot. As can be seen on the labels, loads from 1-ounce to as heavy as 1⅝ ounces have been used by the reloader to fit a wide range of applications from dove and target to turkey.



are not suitable for fold crimping. **Caution:** *All of the data in this handbook is for folded crimps of six or eight points unless otherwise clearly stated to the contrary.*

Regardless of the case brand, primers or wads of a different brand may be used as long as it is within the confines of reliable published data that can be verified in the propellant manufacturer's data. The selection of a particular case style will not limit the loads to be assembled, if there is existing data for the gauge, shell length, case, and load type you wish to use.

Case Inspection

Case inspection is vital. If you assemble a load into a case that has deteriorated, you may well never come close to the hoped for ballistics. Or, far worse, you may assemble an accident waiting to happen.

The inspection of cases is not difficult. You simply discard those cases which show any visual signs of deterioration. And, segregate cases by specific gauge, shell length, brand and style. It will also be necessary to separate any cases having a six-fold crimp from those with the eight-fold crimp.

Look for cases that have become burned or brittle in the mouth (crimp) area. Also examine each for splits and cracks in the mouth or body of the case. Inspect the area where metal head meets the plastic body, looking for signs that the head has pulled away or has become loosened. Check the fired primer for any indications that gas has leaked between it and the primer pocket (black smudge or ring around the primer), and for primers that may have backed part way out of the case. Also watch for any swelling, or concave or convex shaping of the case head, swollen rims or heads, or corrosion of the head itself. Look for burn-throughs in the case body. These are more common with paper cases, but plastic cases are not immune to the problem, especially in 410-bore size. These, and any other signs of abnormality, are all reasons to discard a case.

Develop a routine for your case inspection to ensure nothing is overlooked. For example, first examine the outside of the case. Start with the mouth, the body and then the case head. Roll the case over and look at its base and the primer/primer pocket. Next inspect the interior, being certain no foreign material is inside and making sure the case is completely dry.

Special Polyformed Case Inspections

Polyformed cases are of weaker construction and subject to rapid deterioration. A separate base wad is slipped into a paper or plastic tube. When new, the base wad's tight fit in the tube forms a seal to prevent combustion gases from escaping rearward between the case wall and base wad. Sometimes the base wad has a small lip that is designed to obturate as an extra precaution against gas leakage. The metal case head is then used to secure the base wad and case wall in a solid unit. Often, the wad will have a base lip which fits into the head rim to maintain integrity of the unit.

Polyformed cases can only be reloaded a few times before showing signs of wear and demand extra care during case

Shotshell cases showing these and any other defects must be culled from cases to be reloaded. When ten percent of the cases in a given lot have been culled, it is time to discard the entire lot. Cases do have finite safe reloading life.

inspection. Though they often appear to be of similar construction, they may have base wads of varying heights and each requires different loading data.

When inspecting polyformed cases, use a strong light to help see inside the case. Make sure none of the base wad has been blown away or become burned. Also that there is no space at any point between the base wad and case wall. If there is even a trace of base wad deterioration, don't reload that case. It is entirely possible that a polyformed case may not be found suitable for even a single reloading.

You must also be certain the base wad has not loosened and moved forward. To do so, use a dowel as close to inside case diameter as possible. Slip the dowel into a new case until it has bottomed and make a legible mark on the dowel that aligns with the case mouth. Use this tool to judge base wad position on fired cases by placing it into each case. If the case mouth does not align exactly with the mark on the dowel, discard the case.

How Many Times To Reload A Case

With experience the reloader will learn how many times a case can be reloaded for a specific shotgun and load before the first signs of case deterioration occur and will stop reloading a case prior to that point. For example, if you note that some case mouths begin to split on the fifth firing, then do not reload and fire them more than four times. The idea, of course, is to stop using a case before it begins to fail. With case failures come erratic ballistics. And, case failure is not necessarily progressive, that is starting with minor problems and slowly progressing to catastrophic failure. So, get to understand the reasonable case life for your circumstances and stay below the number of loadings at which even minor failures begin to appear, even if they occur on an infrequent basis.

It is recommended the reloader keep cases segregated with respect to the number of times they have been fired and keep good records to prevent accidents due to too many firings.

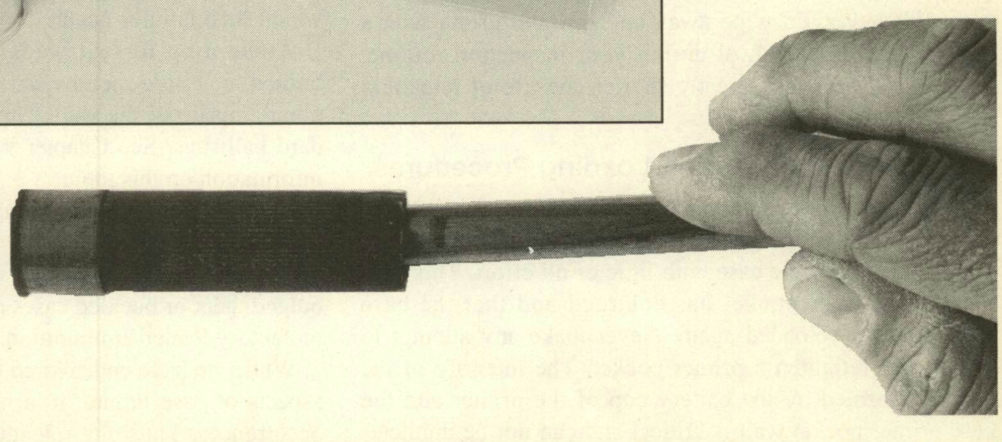
There is no special medal given for those who simply must get eight or more reloadings from a case. In fact, if you run into a shooter who wants to brag about how many firings he's obtained from a case, you may want to put some safe distance between him and yourself. No case lasts forever, and it is far better to be safe than sorry. Early retirement beats death on the job.

Warning: *Unibody cases should generally be considered as used up on the sixth firing even if no failures have occurred. This means the firing of the original factory load and then five reloads. This assumes no negative signs of wear appear sooner. Polyformed cases should never be fired more than three times, the original factory load and two reloads.*

Case Stretching

Shotshell cases can stretch from repeated firings. This sometimes becomes noticeable when crimp forming. The lengthened case causes excess material to be present and this results in a crimp with a spiral twist or other abnormalities.

Shells originally loaded with a roll crimp are not suitable for reloading with a fold crimp. The heavy plastic area at the case mouth, the plastic's memory, and subtle case length variations all are negative aspects that make such fired cases unsuitable for the reloader's purposes.



Polyformed cases must always pass the dowel test before reloading.

Reloaded cases (center) should look very near alike to factory loads (left and right) and display no abnormalities.

When this occurs, it is time to discard the case. We do not recommend trimming cases under any circumstance. Doing so drastically effects the data requirements of the case. See Chapter 11 on crimps and ballistics for more information.

Cleaning Cases

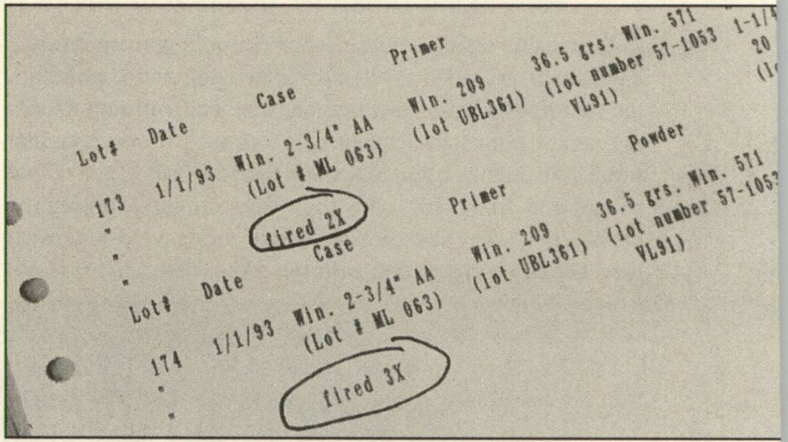
It has been suggested that abnormally dirty cases can be washed and then dried with artificial heat such as being placed in a warm oven. We do not recommend such procedures. Washing can cause severe deterioration of the base wad in a polyformed case, making it unsafe to use. Also, if even a tiny bit of moisture gets between the plastic and metal head, corrosion may start and progress rapidly. This could be dangerous in polyformed cases and result in feeding and extraction problems in unibody types. Just a trace of moisture left in any case could affect primer and propellant.

Exposure to oven heat can deteriorate the base wad of polyformed hulls and degrade the plastic structure on either case type. The heat generated at ignition is, of course, much higher, but because of the short duration, it doesn't do the damage that prolonged low heat from an oven will do.

Therefore, avoid artificially cleaning and drying shotshell cases. However, do wipe away any grit and grime with a soft cloth or paper towel during your inspection routine. Failing to do this can greatly shorten the life of reloading dies.

Case Inspection During Loading Procedures

After each press operation, keep inspection of the case in mind. When decapping the fired primer, watch for a primer that comes out of the case with little or no effort. This suggests the primer pocket has enlarged and that the case should not be reloaded again. Never make any attempt to artificually retighten a primer pocket. The integrity of the gas seal formed by the battery cup of the primer and the case primer pocket wall is critical and can not be duplicated. And if primed, never attempt to decap the live primer.



Carefully maintain records with respect to the number of times reloaded cases have been fired. While circumstances may demand shorter case life, do not exceed six firings for unibody cases or three firings for polyformed cases (be sure to count the initial firing of the factory load).

Case heads sometimes split during resizing, and case mouths will as well while expanding or during wad seating, even during crimping. Discard all cases or loaded ammo on which such failures occur.

Attempting to seat wads into cases with split, torn, burned, or brittle mouths can result in tears or nicks to the obturating lip of the wad. This in turn can lead to substandard ballistics. See Chapter 9 dealing with wads for more information on this topic.

Case inspection is not complete until final inspection of the fully loaded round. Safely discard any assembled ammo that show abnormalities or irregularities. This includes bulged, bent or buckled cases or anything not normally seen on factory loaded ammunition.

While we have endeavored to mention the more common aspects of case failure, it is impossible to foresee all such occurrences. Thus, the reloader must remain alert and discard any case or load exhibiting any characteristic that is different than normal factory ammunition assembled in the same type of case.

Cases and Load Data Interchangeability

The standard target cases as loaded by Federal, Remington and Winchester are Gold Medal, Premier, and AA. The Federal Gold Medal case is made only in 12-gauge, the Remington Premier in 12- and 20-gauge and Winchester AA in 12, 20, and 28 gauges as well as 410-bore.

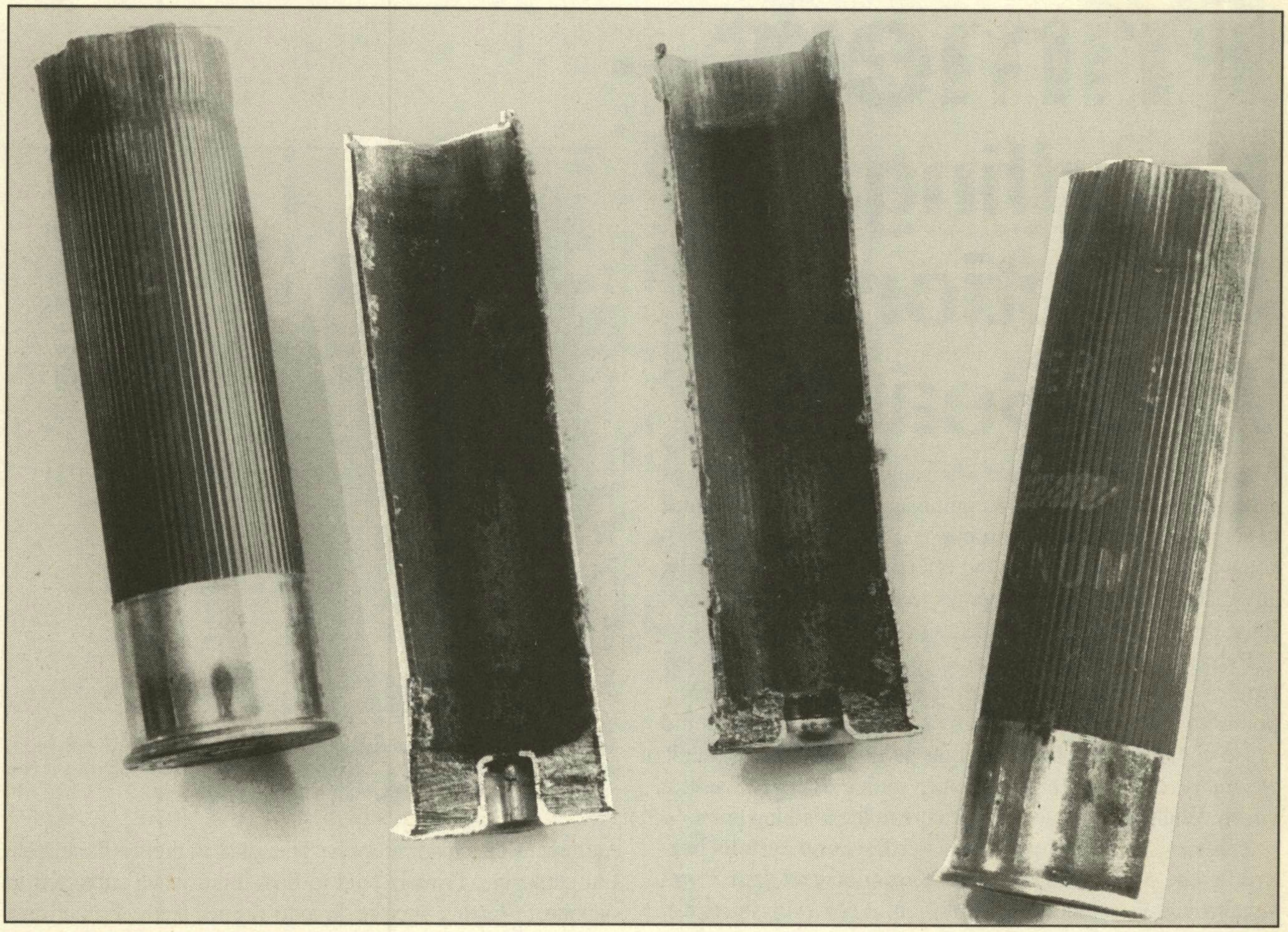
The Winchester AA case is also used for many of Winchester's hunting loads in all gauges. These cases may have a high or low brass head and can be found marked Super-X or with one of the discontinued brand names, Xpert or Upland. **Caution:** *Some older Xpert cases were not of the compression-formed type.* The Winchester Super Pigeon loads also use the AA case.

Federal manufactures a number of cases that are currently ballistically alike though not in a target-grade case. The trade names of these polyformed plastic hull cases are Hi Power, Duck And Pheasant, Field, Game, Dove And Quail, and Top Gun. The new Classic Federal brand is also of this type.

Caution: *Manufacturers can and do change their cases from time to time, without a corresponding change in nomenclature. It is essential that the reloader verify case construction type prior to reloading regardless of brand name nomenclature.*

Starting with any of the three brand name target-style cases will ensure a wide variety of loading data and will allow for ease in load assembly (sizing and crimp forming). The exception would be Winchester Super-X cases with high brass which will require greater sizing effort and hence change the weight of the metered powder charge. Some of the older versions of the Super-X cases will require a switch to a six-point crimp starter.

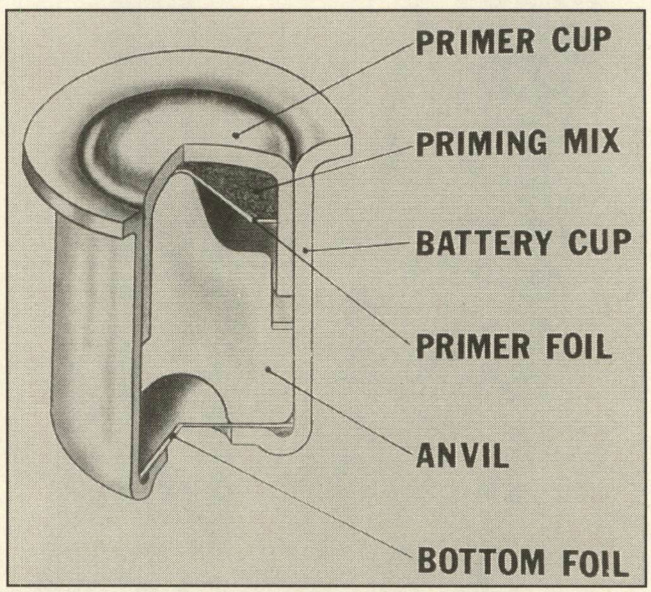
WARNING: *If you have difficulty identifying any case listed in any data, always contact the case manufacturer before assembling ammo. Never load any case which has not been positively identified or which shows any variation from the typical cases of a specific type. It is the reloader's responsibility to ensure that the appropriate cases are being used with specific data.* If you have doubt about case similarity, sometimes cutting a few cases in half can clearly show differences in internal construction. Again, it is best to begin reloading with the various target load cases as these are generally a bit easier to identify than other case variations.



Cutting cases in half can help verify identification or illustrate that what appears the same on the outside is not necessarily the same internally. Note that both cases are external look-alikes, but the internal base wad configuration is noticeably different. The case on the left is a Riefenhauser type with a high inner base wad; the case on the right, a Riefenhauser with low inner base wad. These cases require substantially different reloading data.

CHAPTER 7

Primers–
Handling, Selection, And Seating



This is the typical construction of a shotshell primer. Although, some primer types do not have a bottom foil or seal to prevent fine grain spherical propellants from entering the primer.

A PRIMER MUST explode when subjected to the impact of a firing pin to accomplish its purpose. Then it must produce the hot gases and burning particles necessary to ignite the propellant charge in a uniform and effective manner. Obviously, any material with these properties must be treated very carefully. Primer properties important to the reloader include:

Primers will explode if abused. Abuse constitutes any type of percussion, friction or heat to include hammering, pounding, dropping, impacts or other forces which could cause compression of the priming pellet; fire, sparks, static electricity, hot ashes, and any other source of excessive heat which would raise primer temperature to the kindling point.

Primers stored in bulk are a needless and serious hazard. If one primer explodes, all those in contact with it will simultaneously explode. An explosion of several primers can be serious and have devastating consequences. Primer blasts have caused personal injury and even death.

Primers can and do dust. Minute particles of the priming pellet mix will accumulate in and around primer handling equipment and loading tools. This dust is highly flammable and explosive. Primers tend to dust more when subjected to shaking or jarring such as in auto primer feeds. Primer dust which accumulates in primer feed tubes or magazines and at the priming station can be a fire or explosion hazard.

Primers will deteriorate. If exposed to direct contact with organic solvents which, in part, include thinners, gasoline, kerosene, oil, grease, etc., the primer mix will deteriorate. This can cause misfires, erratic ignition, or possibly delayed ignition. Primers don't normally absorb moisture even from severe atmospheric humidity, so storing primers in an airtight container creates a needless hazard by preventing the rapid venting of expanding gases should ignition occur. Primers should be kept in factory supplied containers and in a dry area that has adequate ventilation.

Safe Primer Handling and Storage

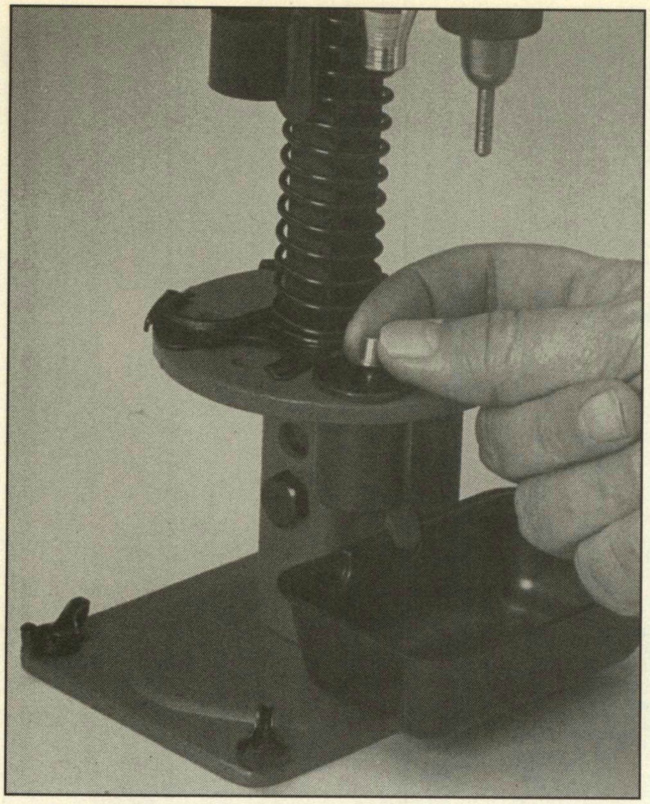
Bulk storage of primers is never recommended. All unused primers should immediately be returned to their original packaging at the end of every loading session. Do not leave primers in the loading tool or in primer feeds.

Primers and Load Identification

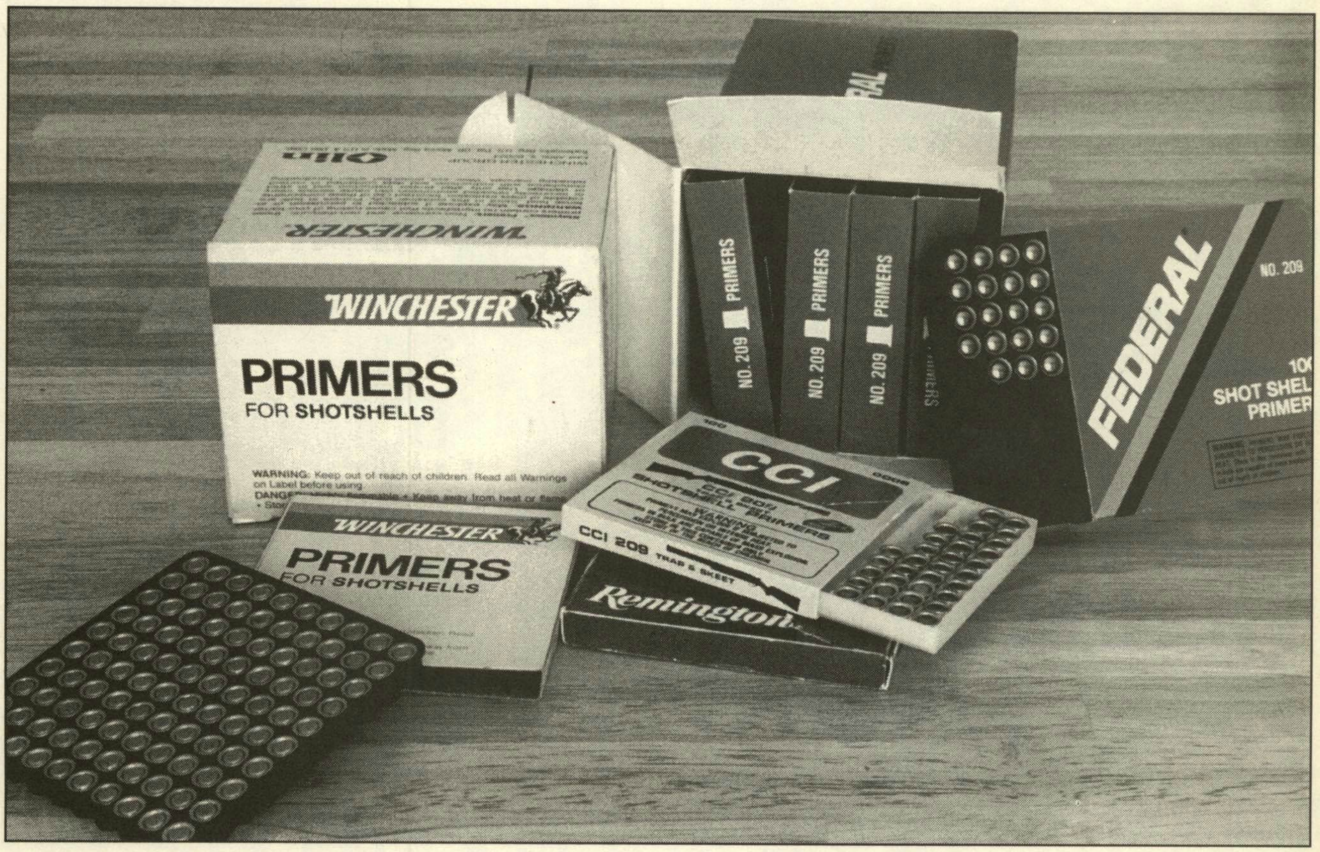
When reloaders assemble different loads using a single case type, primer selection can help load identification. Selecting, say, a CCI 109 and CCI 209 primer (one is plated) makes recognizing two loads containing shot charge weight or pellet size variations easy. Simply be sure to use loading data exactly as specified.

Primer Seating

Proper seating of primers often demands a learned "feel" for the process. This is because many reloading tools do not incorporate an adjustable stop for primer seating. Enough

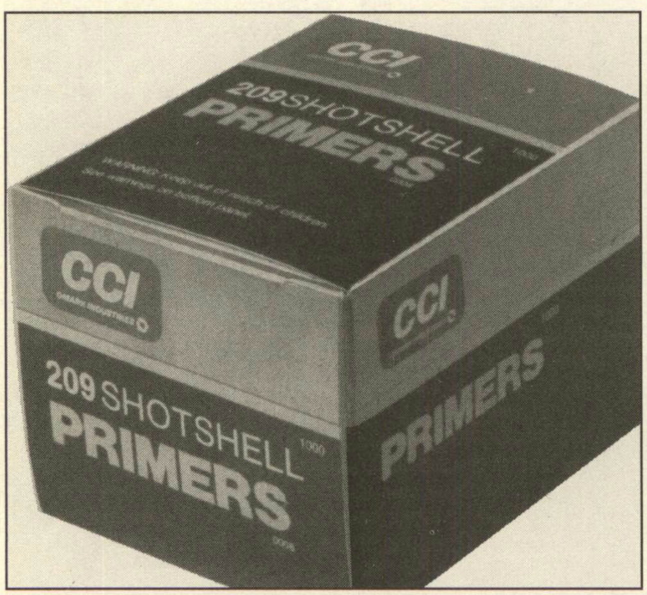


The best and safest way to handle primers is one at a time. But, do so only with clean, dry hands to prevent possible contamination.

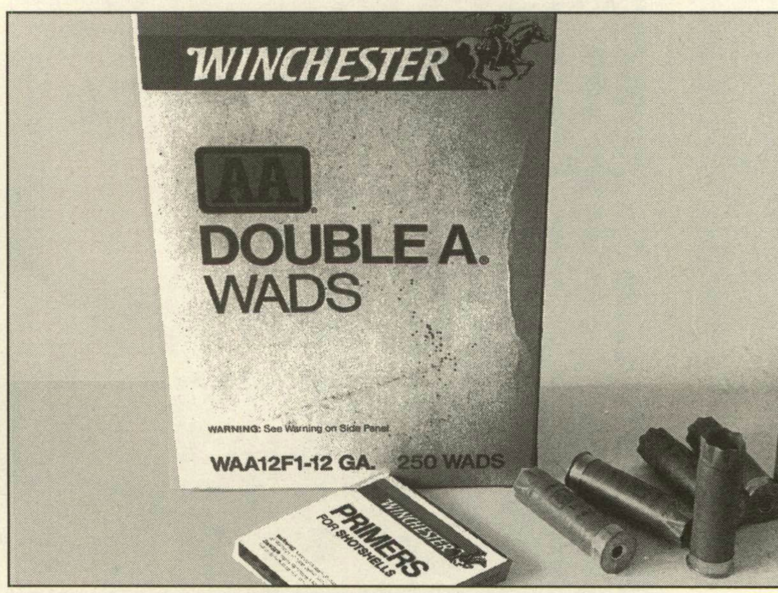


Keep primers stored only in their original 100-unit trays and 1000-unit packs. Never store primers in any other container.

Each primer brand and specification has unique ballistic properties and will produce specific levels of chamber pressure. Primers must never be substituted one for another. Use only the specific brand and style primer listed in the leading data.



Primer nomenclature regrettably is very similar. The CCI 209 primer nomenclature is similar to Winchester's 209, Remington's 209 or 209P, Federal's 209, or the CCI 209M. Yet, ballistic properties do vary considerably and primers must not be interchanged.



Primer compatibility with the selected components in the load is important. If performance of the load is less than expected, one cause may be primer incompatibility with case, wad, shot weight or propellant used. Trying another load with different component combination (supported by existing data) should be considered.

PRIMER TIPS

Primer Storage

Primers must be stored remotely from the reloading bench and should never be stored with any other component. It is especially important to avoid storage with propellant powders. A wooden cabinet of 1-inch-thick boards is suggested since this will minimize heat transfer should a fire occur. Naturally, keep the surrounding area completely free of all combustible material.

Be certain the storage area is free from any source of heat, sparks, open flames, corrosive fumes, or direct sunlight and so on. For example, do not store primers near a furnace, electrical equipment, mechanical equipment, solvents, gasoline, and other like items. Keep the primer storage area away from any bullet impact zones, whether direct or within the potential of ricochets.

The National Fire Protection Association (NFPA) Recommendation #495 states that no more than 10,000 primers be kept in a private residence. Exceeding this quantity will often be a violation of state or local fire laws and could be cause to invalidate homeowners' or renter's insurance. Simply keep no more primers on hand than essential.

Primer Performance

Primers are an important component in the overall loading process. Each brand and type has specific ballistic properties which makes it essential they be treated with respect for their individuality. That is to say, primers cannot be interchanged, one for another, without affecting the ballistics of the loading recipe.

The reloader should avoid falling into the trap of thinking about a specific primer as "hot" (producing greater pressure) and another as being "cool" (producing lesser pressure). Primer performance can vary substantially depending on all of the other components and the pressure generated by the load. For example, the CCI 209M primer can behave like a magnum primer in some loads or as a standard primer in others. Trying to extrapolate how a primer will perform based on published data using dissimilar, or even similar, recipes can lead to erroneous conclusions. Never assume any level of performance, and never substitute one primer for another.

The level of primer performance variation can be surprisingly great. Starting with a load that produces 10,000 psi (pounds per square inch) of pressure, it is easy to make a primer switch that can cause pressure to increase (or decrease) by 2000 psi. This is a substantial change, about 20 percent. With careful manipulation of the selected components in the load, greater change is possible.

Never attempt to use a CCI 209M for either the CCI 109 or CCI 209 primers, despite the name similarity. The same applies to Remington's 209 primer—never substitute it for a Remington 97* or Remington 209P primer. However, the Remington 209P and 97* primers are interchangeable, as are CCI 109 and 209. In short, except for the two exceptions just noted, use only the exact primer shown in the loading recipe. To do otherwise can be dangerous.

On some occasions, primers may perform similarly in specific loads. Do not let such data mislead you into believing that this is a general condition.

Primer compatibility with specific component combinations—propellant, powder, wad and shot weight—can vary. When a sophisticated data supplier tests a load, performance at elevated and suppressed temperatures are considered as well as such characteristics as muzzle flash and clean burning of the propellant charge. Still, the reloader should be alert to less than perfect performance characteristics. If dirty burning occurs, if there is excess muzzle flash, or if performance deteriorates with a reduction in ambient temperature, it would be wise to discontinue the use of the load, selecting instead another that performs as expected.

Because a primer can cause substantial ballistic changes, the use of new factory-primed cases must be approached carefully. Be certain the primer in such cases is the one listed in your loading data. Some new factory-primed cases use a primer not available to reloaders and, hence, no useful data is available. If the packaging does not specifically state primer type, do not load the cases until you have verified the primer type with the manufacturer.

Primers stored or handled in bulk creates the hazard of serious explosion. Therefore, primer manufacturers do not recommend the use of automatic primer feeds. If the reloader must use an auto primer feed, it must be remembered that there exists the potential for an explosion at the loading bench. All such feeds must be adequately shielded to prevent the force of an explosion from reaching the operator. The responsibility for adequate shielding must be borne by either the primer feed manufacturer or the reloader.

Keep in mind that a jammed primer feed should be handled with extreme caution. Never attempt to lightly tap a jammed feed in order to free it. Instead, very carefully remove all primers and disassemble the unit. Never apply any amount of force to a jammed unit. A crushed primer can explode, igniting all other primers contained in the unit, and cause severe injury, even death. Do not use the unit further until the reason for the jam has been properly rectified.

Never attempt to decap a live primer, simply discard the case and primer in a safe manner. The cost of either component isn't worth the risk of injury or worse.

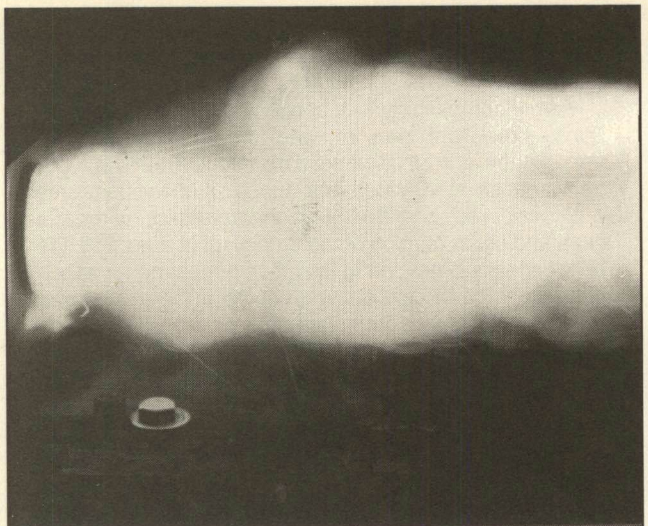
Precautions must be taken to prevent the build up of static electricity on the person doing the reloading or the equipment. It is highly recommended to electrically ground all reloading equipment. Consult an electrician before grounding your tools.

Clean all loading tools and primer handling equipment with a damp cloth to wipe away any accumulation of primer dust. Pick up any dropped primers immediately to prevent stepping on them or sucking them up in a vacuum cleaner.

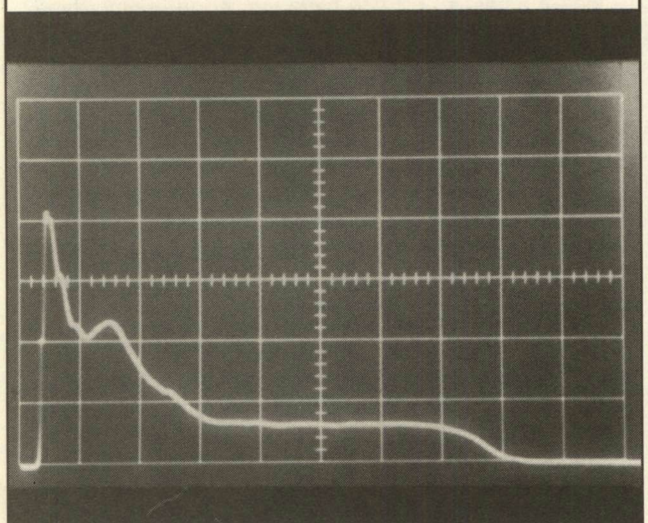
Never place more than one box of a hundred primers on the loading bench at a time. Keep all other primers stored in a remote area.

Safety glasses should be worn at all times when working with primers.

The safest possible way to handle primers is one at a time. Picking up a single primer and placing it into the primer station may take a second or two of extra time, but the hazard of bulk handling is eliminated. Naturally, it is important to have clean dry hands when working with primers to prevent possible contamination.



Shotshell component primer. Flash photograph (70°F). Note the large volume of white-hot gas being discharged.



Shotshell component primer. Intensity of energy being released (70°F). Graph measures intensity vs. time in milliseconds.

Each primer has a specific set of performance characteristics dependent upon the circumstances of application. These characteristics are not always predictable, and the reloader must not assume any specific level of performance based upon performance in similar or dissimilar data.

force must be applied to bring the battery cup of the primer flush with the case head. This may or may not result in some gap occurring between the primer battery cup and the case. Never use more force than is necessary.

High primers, that is primers sitting above flush with the case base, must be avoided. During the final loaded round inspection, should you discover a high primer, do not attempt to reseat it deeper. Instead discard the improperly loaded round in a safe manner. To do so, please refer to the SAAMI pamphlet entitled, "Properties of Sporting Ammunition and Recommendations for Storage and Handling."

Primer Safety

Primer safety demands attention to all the details discussed in this chapter. However, it is impossible to predict every condition which could affect safety. It is the reloader's responsibility to avoid all potential causes for accidental ignition or inappropriate primer application. Should a question arise, seek immediate assistance from the primer manufacturer.

Primer Function

Primers most often contain one of the two generally used forms of lead styphnate, though some development has been done on lead-free primers. Lead styphnate crystals are fractured when the priming pellet is crushed between the primer anvil and cup by the firing pin blow. When crushed, these crystals explode, igniting other fuels in the priming mix. Other materials are often present in a primer to increase its sensitivity or to alter its brisance.

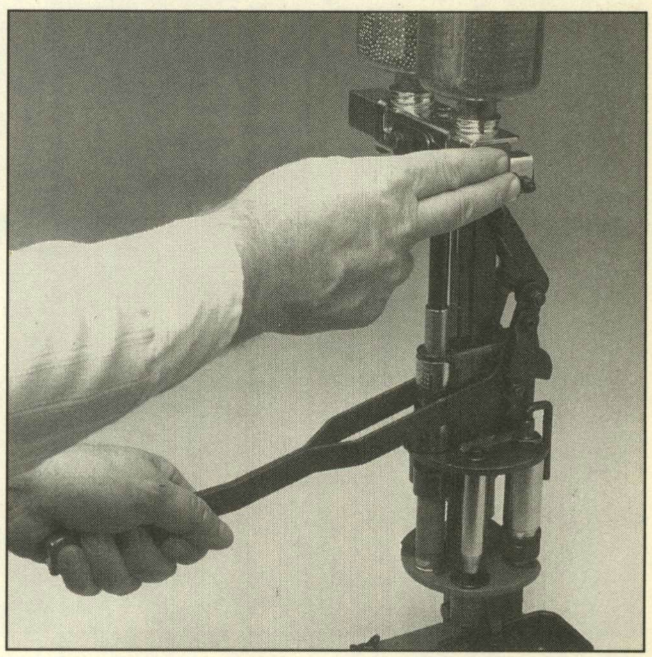
The priming mix may include tetracene, barium nitrate, lead peroxide, antimony sulfide, calcium silicide, glass and so on. The exact chemical composition and percentages of chemicals, and primer pellet weight, varies from manufacturer to manufacturer and by primer type. Performance variation can be notable depending upon intended application. For example, primers intended for the 410-bore have substantially different ballistic characteristics than those designed for general application.

A major difference in some shotshell primers is the covered flash hole, or lack of such. The covered flash hole is essential when using Ball or spherical powders to prevent powder from entering the primer. Remington primers which have an open flash hole should not be used with these powder types. The reloader should question any data source showing such applications.

Primers must be seated so as to make the battery cup flush with the case head. The primer on the left is too high and the loaded round should not be used. The primer on the right is correctly seated. A small gap between the primer battery cup and case head, as shown on the right shell, can be normal.

CHAPTER 8

Propellants—Handling, Selection, Charging, Safety And Storage



The powder that you meter into your shotshell cases is a critical component. It must be compatible with the components used, and it must be uniform in charge weight.

SMOKELESS PROPELLANTS are manufactured in several configurations: small cylinders (with one or more perforations running through the grain from end to end); small spheres (solid round balls or balls that have been flattened to some degree); thin circular wafers, flakes or cords that can be diamond, square or hexagon shaped; or ribbons.

Powders are either single-base, deriving their energy solely from nitrocellulose; or double-base, deriving their energy from a combination of nitrocellulose and nitroglycerine. Once ignited, all powders burn very rapidly and vigorously, giving off great quantities of heat and gases. Oxygen is generated during the burning and, hence, oxygen from the atmosphere is not required to sustain burning. Generally, once ignition has been initiated, burning continues until the propellant has been completely consumed.

Burning Speed

A perforated powder burns both from outside to inside and from inside to outside, maintaining about an equal surface area during the burning. Such powders are said to have a neutral burning rate. However, if the outside of the powder is coated or impregnated with a deterrent (as is most common), it will burn primarily from the inside to the outside creating a larger surface area as the propellant is consumed. Under these conditions, the powder is said to have a progressive burn rate. A spherical powder provides a smaller surface area as it burns, giving it a regressive burn rate. A propellant's actual burning characteristics can be greatly modified by the geometry of the granulation, chemical composition or the use of coatings and/or impregnations.

The speeds at which powders burn are carefully controlled to keep pressures at desired levels. This is accomplished by optimizing the burn rate in combination with the increase in "chamber" size as the ejecta is moved down the barrel. If the burn rate is too slow, burning may stop; if it is too fast, pressures may rise to a dangerous level.

Ignition and Burning Characteristics

Powder is highly flammable and can be ignited by raising the temperature of the granules to the kindling temperature. Generally, nitrocellulose will ignite at 300 degrees centigrade (572 degrees Fahrenheit), but this varies with the specific total chemical composition of the propellant and other factors.

Any source of flame, sparks, heat from fire or hotplate—even heat not applied directly to the powder—can cause ignition.

When powder burns, the enormous volumes of high-temperature gases, if contained, will cause very high pressures in the containing structure. The rate of pressure generation can, however, be kept low if there is adequate space for the venting of the gases being produced. For example, a pound of powder spread on the ground will not result in high pressures

Selecting powders that will cover a wide variety of shooting applications and gauges can help keep powder inventories at a minimum and reduce the chance of selecting an erroneous speed from your stock.

because there is nothing to contain it.

In this regard, propellant powder differs dramatically from high explosives such as dynamite or other blasting agents, although they share certain common ingredients.

The consumption of powder is described as either very rapid burning or explosive burning. Propellant powder gases must be confined to raise the pressure enough to result in explosive burning. Otherwise consumption merely remains at a rapid burning level. Typically, the burn rate in explosive burning is several inches per second and total burn time in a cartridge case is but a few milliseconds.

As pressure increases in a chamber, the burn rate of a propellant also increases. Generally, at a pressure of say 10,000 psi, a propellant might burn at 2$^1/_4$ inches per second, while at 20,000 psi the burning rate might increase to 3$^1/_4$ inches per second. Burned in the open, the propellant burning rate would be well below $^1/_2$-inch per second.

The size of powder granulations varies from very small (smaller than a grain of sand) to rather large (2$^1/_2$-inches long by 1-inch in diameter) depending on application. The smaller granulations are often the faster burning and the largest the slowest burning, in a comparative sense. Again, actual burn rate for a specific powder varies based on specific composition and size as well as the conditions under which it burns, i.e. the volume and shape of the cartridge case, weight of the shot charge, bore diameter, pressure reached during burning, the specifics of ignition and the primer.

Unlike blackpowder, which burns at approximately the same rate whether in the open or confined, smokeless powders always burn faster in confinement. The geometry and chemistry of smokeless propellants are carefully adjusted to obtain very specific results under specific ballistic conditions.

Deterioration of Smokeless Powders

All smokeless powders are subject to deterioration. However, if proper storage conditions are maintained, modern propellants are designed for a very long shelf or loaded round life. Nonetheless, safe reloading demands that the reloader be able to recognize signs of deterioration.

The first sign of powder deterioration will be an irritating acidic odor when the can is opened. Don't confuse this with the smell of solvents such as alcohol, ether or acetone which are likely to be present. Should there be an acidic odor, the powder should be disposed of in a safe manner.

The best way to dispose of unwanted powder is to burn it outdoors in small shallow piles not more than 1 inch deep. Never have more than one pound on hand to be burned. Use an ignition train of a slow-burning combustible, newspaper for example, to allow sufficient time to withdraw to a safe distance before the main propellant pile ignites. Make doubly sure there are no sparks or hotspots on the ground from the last burn before pouring another pile of powder.

Storage Of Smokeless Powder

Because propellant powders are designed to burn vigorously and produce enormous amounts of pressure generating hot gases, they must be carefully stored. The National Fire Protection Association's (NFPA) Recommendation #495 makes specific storage and handling recommendations which are law in many municipalities. Failure to comply is not only foolhardy but could adversely affect the insurance coverage on a dwelling or structure.

Some NFPA instructions include not transporting more than 50 pounds of powder (in an approved portable magazine) in a private vehicle or storing more than 50 pounds in a residence. No more than 20 pounds are to be stored in a residence if an approved storage box or cabinet is not used. Storage must always be in the original factory containers.

Storage cabinets must be built of 1-inch thick wood with one or more weak walls that will easily push out to allow venting of gases before internal pressures build up to a dangerous level. Factory containers are designed to allow venting and this safety feature should not be compromised by storing powder in a strong container that, in effect, could become a bomb.

The storage area must, naturally, be free of other combustibles like primers, solvents, flammable gases and so on. Nor should the storage area be a confined space. Allow plenty of room for gas venting in case of a household fire. Do everything possible to avoid heat build up, fire or other potential causes of ignition in the storage area.

Powder Charge Weight

The powder charge weight thrown during the reloading operation must match the charge weight listed in the data section. Unlike metallic cartridge reloading, it is unnecessary to work up to a listed load when assembling shotshells. Indeed, the use of a reduced load could cause poor ballistic performance.

Variations from charge to charge will occur when metering powder on the press. However, the variation must be small or it is possible that excessive pressure (powder charge too heavy) or substandard ballistics (powder charge too light) could result. Charge variation should never be less than nor exceed 3 percent of the listed data.

It is not safe to simply meter ten powder charges in a row in order to obtain an average charge weight. Charges weighed in this fashion will invariably be light compared to charges thrown during actual reloading due to press vibration. Nor is it realistic to expect the metered charge to correspond exactly to the charge weight listed in a bushing table. Charge weight variations depend upon the press operator—a "heavy" hand gives a heavier charge weight than a "light" hand. In short, the more vibration and/or pounding a tool receives in normal cycling, the greater the weight of the metered propellant charge. For example, cases which require more resizing effort will result in a heavier powder charge than cases which require less resizing. **Caution:** *It is vital that you follow the instructions in the Chapter 13 to determine the actual charge weight being thrown by the powder bushing.*

Powder Selection

Powder consumption and burn rate go hand in hand. The faster a powder burns, the less of it used in a load. If economy is a consideration, then select loads using the fastest burning powders. This is because lower charge weights will be used. These same powders often are also the cleanest possible burning, leaving a minimum of residue to foul barrels and actions.

Consideration should also be given to how the selected powder meters through the loading tool. Often, spherical or Ball powders provide very uniform metered weights. The drawback to these types is they tend to "weep" through the tool assembly joints and in and around the sliding surfaces of the metering unit. MEC offers special washers to help eliminate this problem. Large flake powders tend to meter the least uniformly. The reloader may want to weigh each charge on a scale if charge uniformity varies by more than plus or minus 3 percent from the nominal charge.

Perhaps the most important consideration in selecting a powder is versatility. The problems of excess inventory and using the wrong propellant are greatly reduced if the reloader uses the fewest possible types of powder. This may not always be the most economical route, but the added safety is well worth a few extra pennies per shot.

Dram Equivalent

Shotshell makers still often use the outdated "dram equivalent" system for rating velocity/shot weight performance. This system is discussed in Chapter 14: Ballistics for the Shotgunner. However, for now, remember that dram weights must never be used when working with modern smokeless powders. To do so would be extremely dangerous.

Powders Used in the Data Section

The propellants shown in the data section of this book were chosen on the basis of general reloader popularity, widespread distribution, and proven load performance to ensure that these loads perform as expected. Another reason for using a specific propellant was to provide the reloader with a cross-reference for double-checking data against manufacturers' literature.

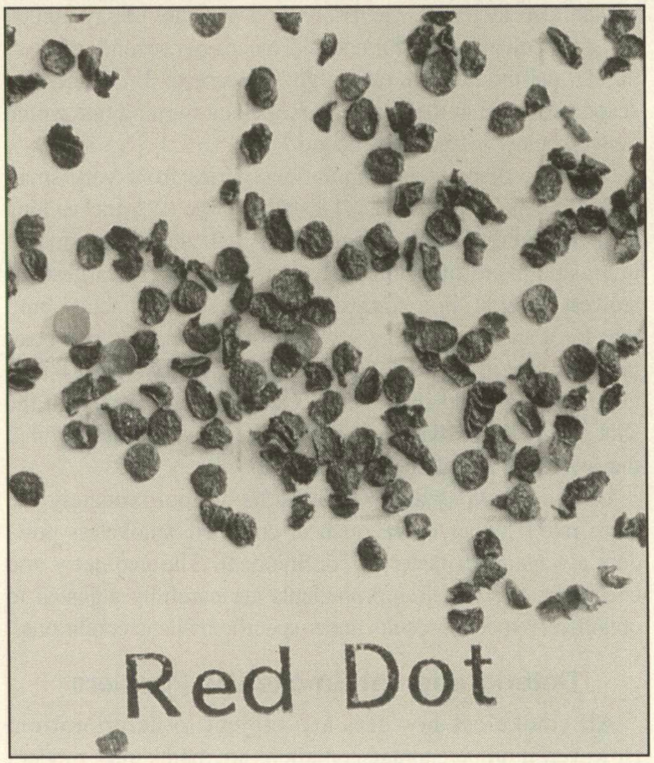
There are many other powders suitable for shotshell reloading. However, space considerations and proven load performance limit our load listings. We trust those loads found here will perform satisfactorily and the reloader won't need to try a number of recipes for full satisfaction.

If selecting data for a semi-auto shotgun, two areas of powder performance are very difficult to predict. These are their ability to function all types of semi-automatics and to burn cleanly under all conditions. Semi-autos need sufficient gas port pressure to function the gas-operated type guns or sufficient rearward momentum to function recoil-operated types. The cleaner burning powders help prevent fouling which would interfere with positive operation. The reloader can help avoid these difficulties by using the faster burning powders (where there is a choice) and by selecting loads which have a chamber pressure in the upper levels of acceptability.

The faster powders use the lightest charge weights to achieve a given level of velocity and often produce higher pressure levels. Very light shot charge weights and lower velocities often mean low recoil levels and/or low chamber pressure, indicating loads that may not create enough pressure to cycle a semi-auto.

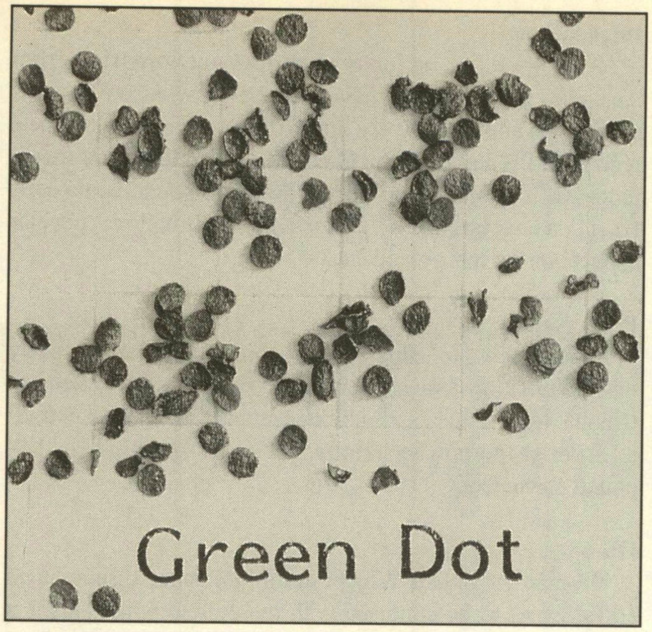
A brief listing of each of the twenty or so shotgun propellants used in the data follows. Though the listing generally follows in alphabetical order by manufacturer and by burning speed within the makers' types, no specific conclusions should be made based on the order of listing. Powder ballistic characteristics cannot be forecasted and will vary with the specifics of the exact load details.

Hercules



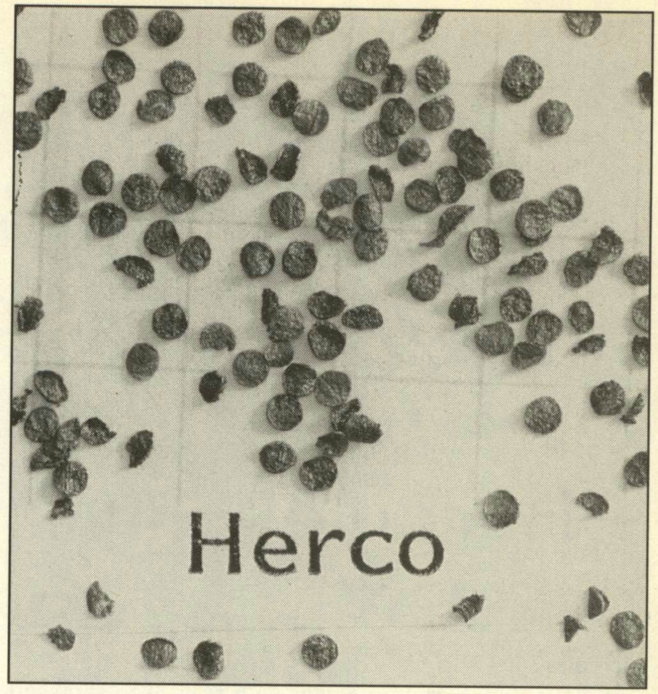
Red Dot

This is, perhaps, the most popular shotshell reloading powder and is used primarily for 12-gauge target loads, though there are specific applications for light and standard loads in 12, 16 and 20 gauges. It is the fastest burning Hercules shotshell propellant used in our data and is sold in 1-, 4-, and 8-pound kegs. As with all Hercules shotshell propellants, this is a double-base powder. The geometry of Red Dot is a general wafer-type shape. The propellant has small quantities of red colored wafers, hence the Red Dot name. Skeet, trap and Sporting Clays are all favorite applications for 12-gauge fans.



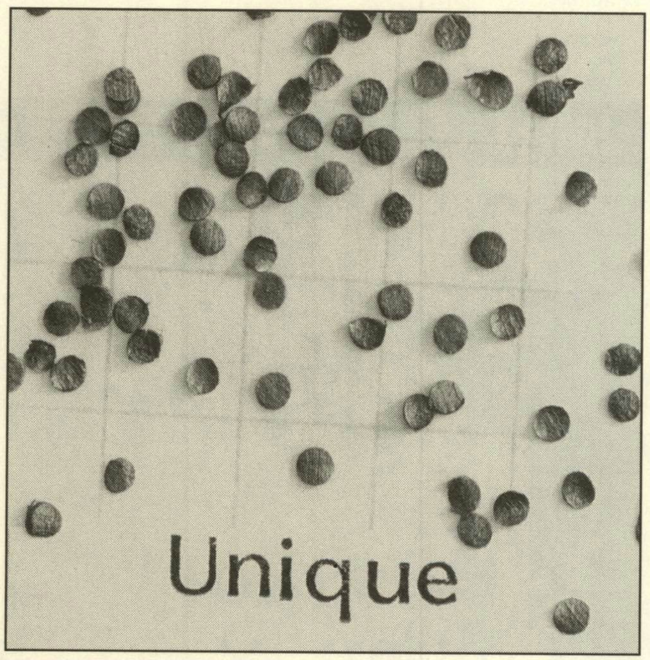
Green Dot

A slightly slower burning propellant than Red Dot with a granulation of similar size and shape. It is generally used for standard and medium shotshell loads from 12- to 20-gauge. It is a double-base propellant sold in 1- and 4- pound canisters, as well as 8-pound kegs. It has a small quantity of identifying green wafers.



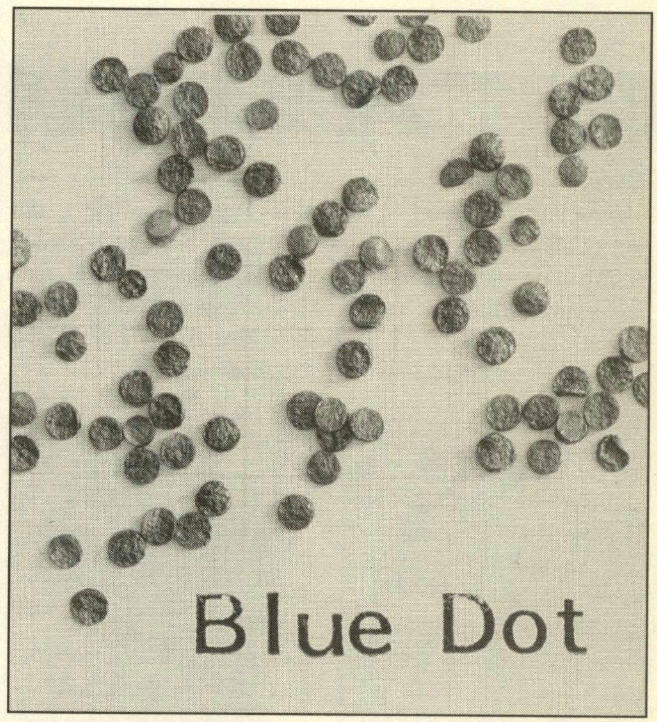
Herco

Herco is a double-based powder of moderate burning speed. Its major applications tend to be for heavy loads in 10- to 28-gauge. It also has a wafer or disc shape and is sold in 1- and 4-pound canisters as well as 8-pound kegs.



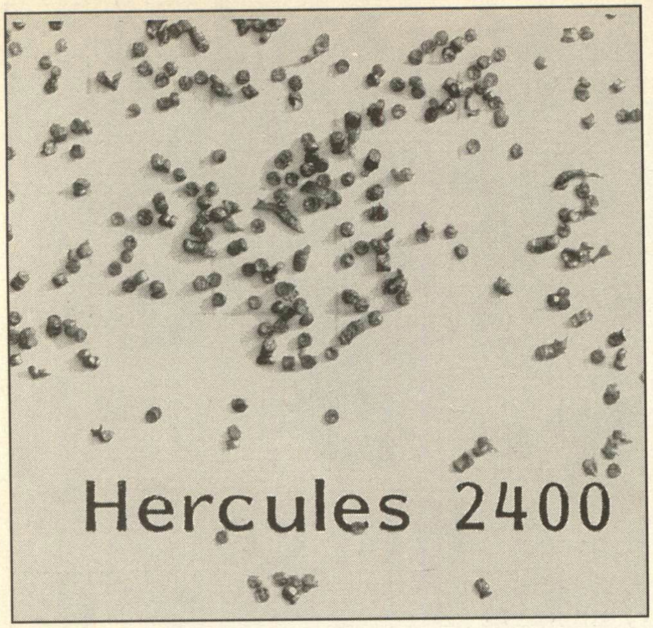
Unique

A very versatile propellant used for 12-, 16-, 20-, and 28-gauge reloading. It often makes a good choice for the reloader who wants to load multiple gauges with a single propellant. Like the two previously mentioned Hercules powders, it is of double-base formulation and is sold in 1-, 4-, and 8-pound kegs. This propellant has the same disc or wafer geometry as the two previous Hercules powders. It is very popular with 20-gauge Skeet shooters.



Blue Dot

This is a slow burning propellant and, therefore, has limited applications. Its primary use tends to be magnum loads from 10- to 28-gauge. Packaged only in 1- and 5- pound canisters, it has the same basic disk shape and double-base construction as all previously mentioned Hercules powders.



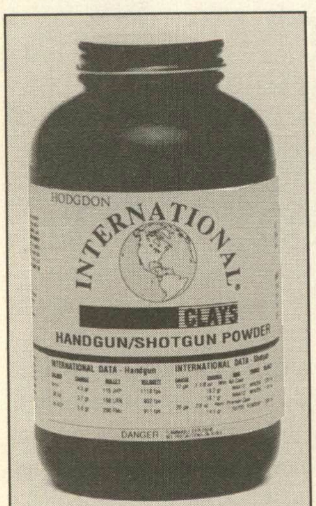
Hercules 2400

A very slow burning powder with respect to shotshell applications. It is limited to 410-bore loads. It has a short, perforated, tubular shape, different from other Hercules shotshell powders. It is of a double-base construction and is sold in 1- and 5-pound canisters. It is unlikely that a 410 loader would use enough propellant to justify the purchase of the available 8-pound keg size.

Hodgdon

Clays

The burning speed of this wafer-type propellant is not unlike Hercules Red Dot. It is the fastest burning Hodgdon shotshell powder. Since it is a relatively new propellant, data is somewhat limited. We have shown applications for 12-gauge target loads. Clays is a double-base extruded propellant sold in 14-ounce and 4- and 8-pound containers.



International

New Hodgdon wafer-type propellant imported from Australia. It was actually announced after work on this volume began and data is very limited. It is intended to compete with IMR PB and Hercules Green Dot, though specific data is required. It is sold in 14-ounce, 4- and 8-pound containers. Hodgdon suggests that 20-gauge target loads will be a popular application for this propellant.

Universal

Another new Hodgdon powder, announced simultaneously with International. It is designed to compete with Hercules Unique. Data is necessarily limited at this time. It is an extruded flake-shape powder that is sold in 14-ounce, 4- and 8-pound containers.

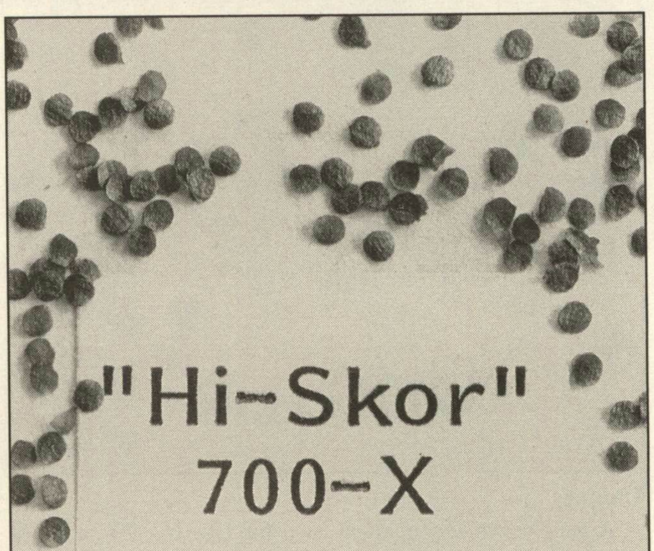
HS-6

HS-6 is not unlike Winchester's long since discontinued 540MS (not to be confused with the current 540). This is a double-base, flattened, spherical propellant sold in 1-, 5- and 8-pound containers. It is a moderate speed powder most often used with heavy loads.

HS-7

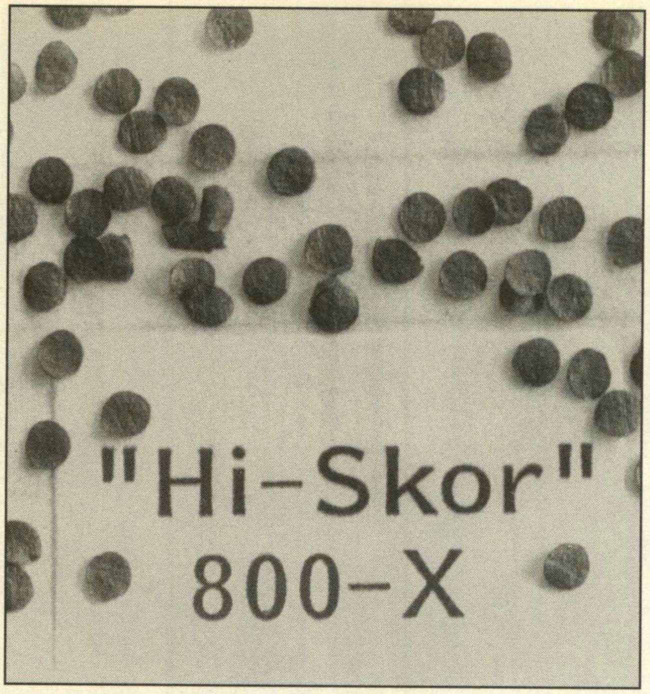
This is a flattened, spherical, double-base propellant similar to Winchester 571. As such, it is slow burning and usually reserved for magnum loads. It is packed in 1-, 5- and 8-pound containers.

IMR



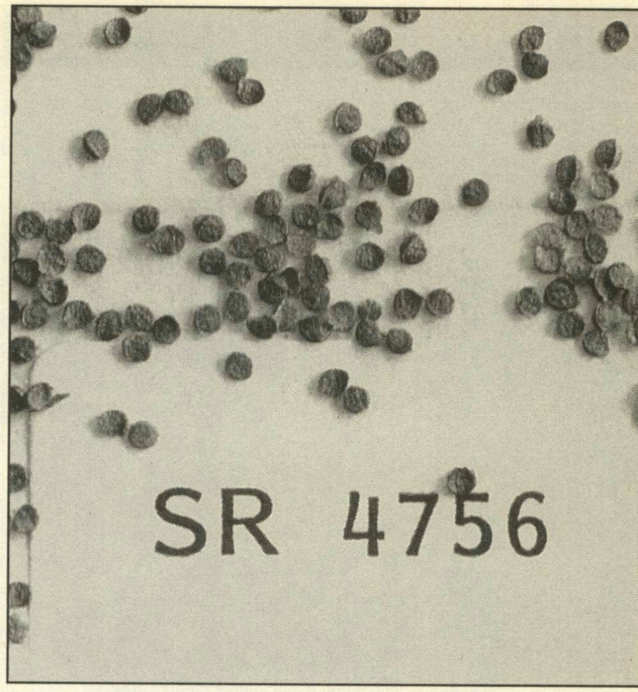
"HI-SKOR" 700-X

"Hi-Skor" 700-X is the fastest burning IMR shotshell powder with a reputation for being very clean burning. It is most often used for 12-gauge target loads though potential application is somewhat broader. It is sold in 1/2-, 5- and 12-pound containers. This is a double-base powder with a flake (disk) shape.



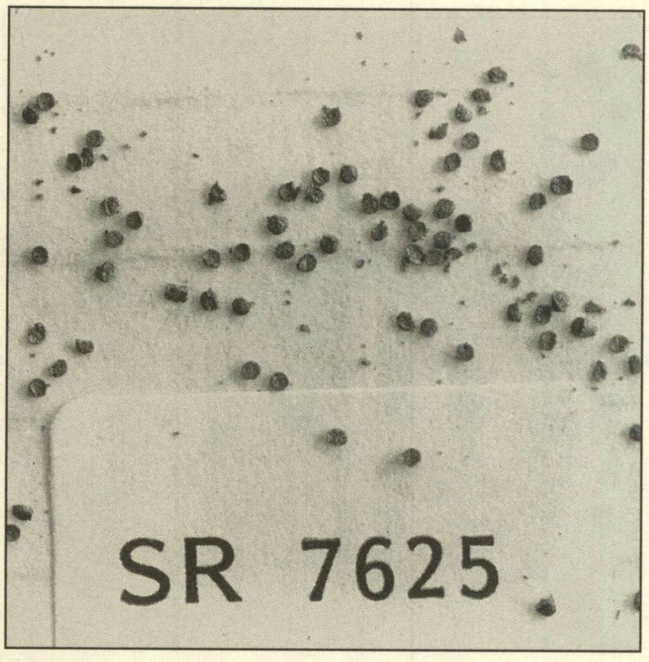
"HI-SKOR" 800-X

This powder is the only other IMR powder with a double-base formula. It has the same basic disk-like shape as 700-X, though it is somewhat slower burning. This is a very versatile propellant for the reloader who wants to assemble a wide variety of loads with a single powder. It is packaged in 1/2-, 4- and 12- pound containers.



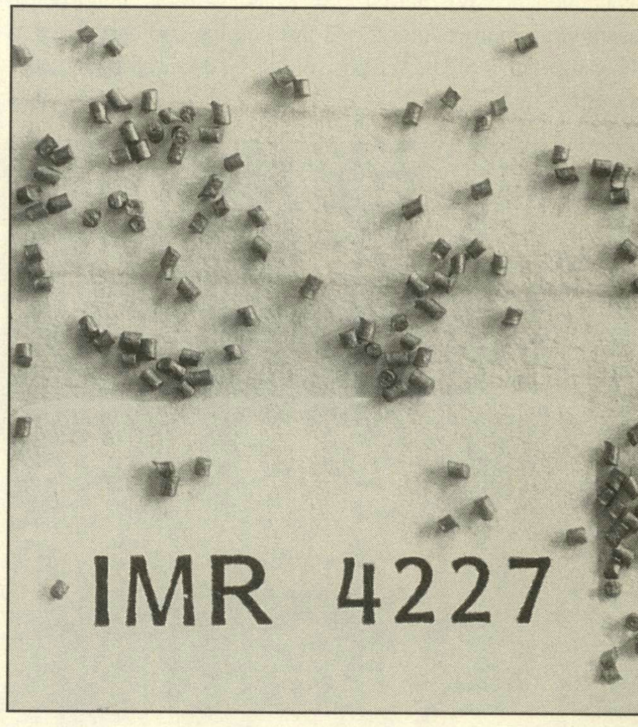
SR 4756

A rather slow burning powder for shotshell loading and, thus, is often employed in magnum loads. Single-base construction with a flake (disk) shape, it is sold in 1/2-, 4- and 12-pound containers.



SR 7625

The SR nomenclature stands for "small rifle." Nonetheless, this is a very useful shotshell powder suitable for a wide range of field and other loads from 10- to 28-gauge. It has a single-base and a small, disk-like grain construction. SR 7625 is of medium burning speed and is sold in 1/2-, 4-, and 12-pound containers.



IMR 4227

When used in shotshell applications, IMR 4227 is an extremely slow burning powder and therefore its applications are limited primarily to the 410-bore shells. IMR stands for Improved Military Rifle and is somewhat of a misnomer. This is a single-base, perforated, tubular-grain powder and is sold in 1- and 8-pound containers.

Super-Lite (WSL)

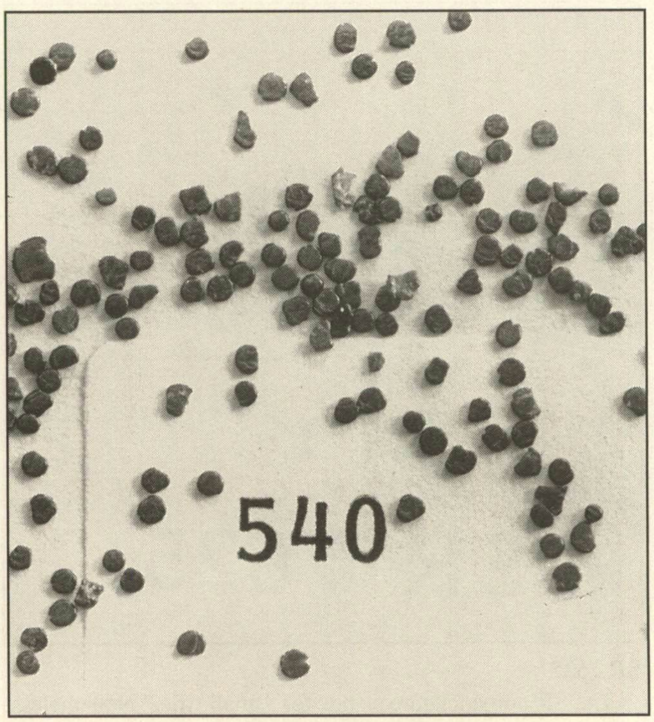
This is a comparatively new propellant and is of double-base, flattened, spherical shape. This Ball powder is the first of a new line of Winchester Improved Ball powder propellants, available since Winchester's St. Marks, Florida, plant began using virgin nitrocellulose. It is fast burning and best suited to 12-gauge target loads. WSL is sold in 1-, 3- and 8-pound containers.

Super-Target (WST)

Another in the new series of Ball powders, this is a relatively fast powder that replaces the old Winchester 452AA. *Data is not interchangeable.* It has a double-base formula and is of a flattened sphere shape. This is primarily a 12-gauge target load powder and is sold in 1-, 3- and 8-pound containers.

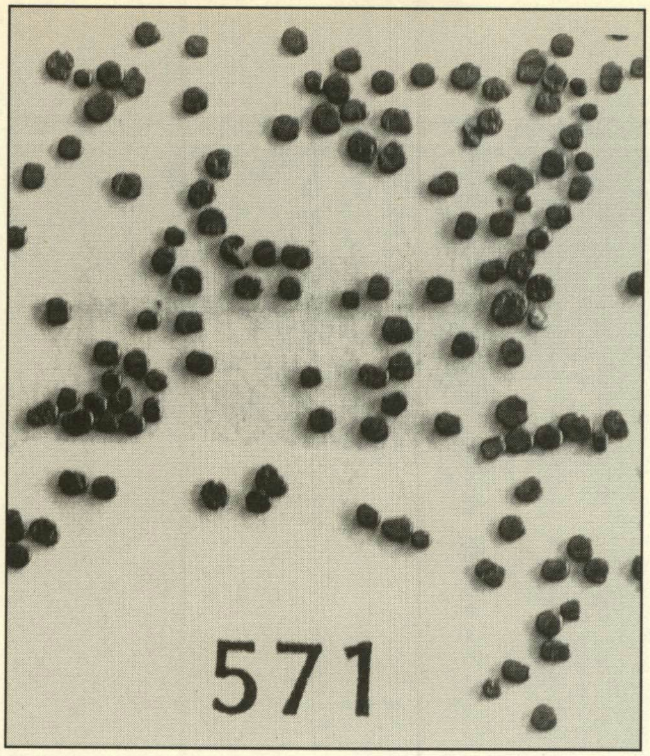
Super-Field (WSF)

Slightly slower powder than WST and generally replaces the older 473AA powder. *Data is not interchangeable.* As with all listed Winchester Ball powders, it is a double-base formula and has a flattened spherical shape. It is useful for 20-gauge target or field loads. WSF is sold in 1-, 3- and 8-pound packaging.



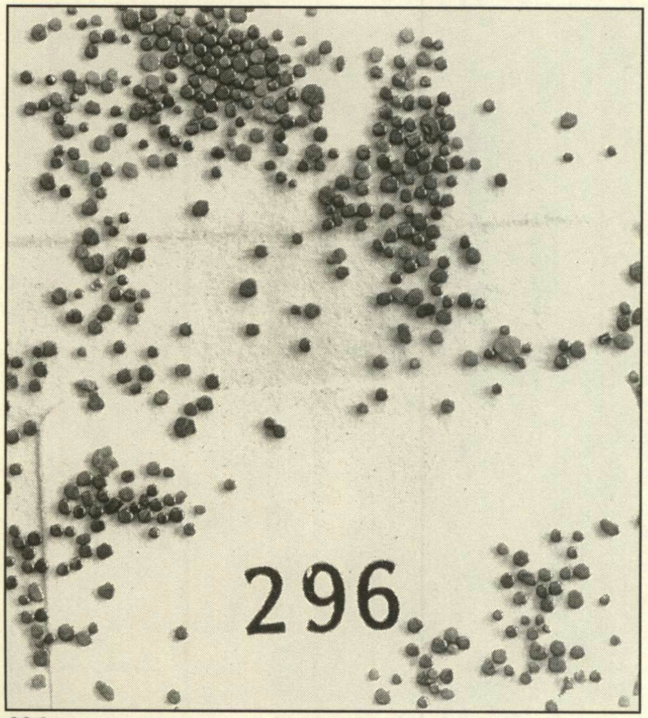
540

This is a somewhat slow burning propellant primarily used for heavy field loads. It is double-base and has a flattened ball shape. Also popular for 28-gauge reloads, 540 is packaged in 1-, 3- and 8-pound cans.



571

This double-based powder is relatively slow burning and thus often used for magnum loads. It has the familiar Winchester flattened sphere shape and is sold in 1-, 3- and 8-pound containers. It is popular for reloading 3-inch shells in both 12- and 20-gauge.



296

The slowest burning of the Winchester powders useful for shotshell applications. Due to its slow speed, it is used only in 410-bore shotshells. It is sold in 1-, 3- and 8-pound cans.

Important Health and Safety Considerations

*Never smoke while reloading, handling propellants or when in an area where powder is stored.

*Never use any spark-inducing equipment in the vicinity of propellant powders.

*Never mix, blend, or otherwise combine propellants.

*Keep propellants out of the reach of incompetent persons and children.

*Never use propellants unless full and undivided attention is given to the procedure.

*Avoid any and all sources of potential ignition.

*Never have more than one pound of powder at the work station. If powder is purchased in multiple-pound containers, pour out only enough to fill the powder hopper and then return the remainder to its storage area.

*Always check the powder charge weight as it comes from the measure at the beginning of each loading session. Be sure to read the important information on how this must be done in Chapter 13.

*Clean up any spills immediately using a dust pan and brush. Never use any power equipment to pick up spilled powder and never attempt to use cleaned up powder.

*Store powder only in its original factory containers and in approved storage conditions.

*Never, for any reason, purchase powder in any container other than the original factory-sealed container. Never repackage powder.

*Be sure the powder container is completely empty before discarding it, and never use powder containers for the storage of any other material.

*Wear safety glasses when handling and using powder.

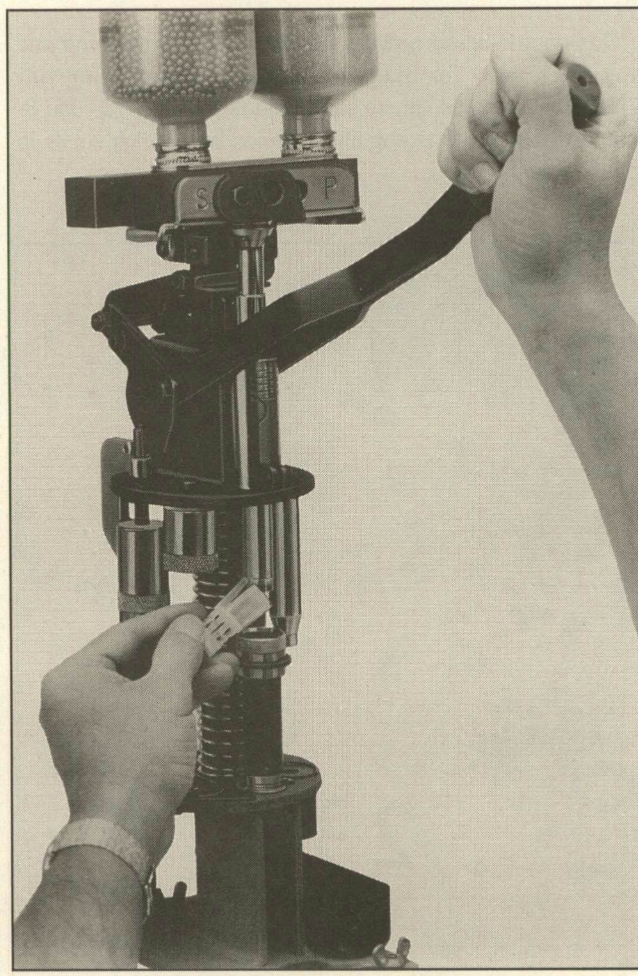
*Remember the highly flammable nature of propellant powders.

*Double-base powders contain nitroglycerin and inhalation of fumes, contact with skin and ingestion must be avoided. Follow powder manufacturer's cautions.

*Never put more than one pound of powder into a powder measure hopper. Less is better.

CHAPTER 9

Wads—Selection And Use

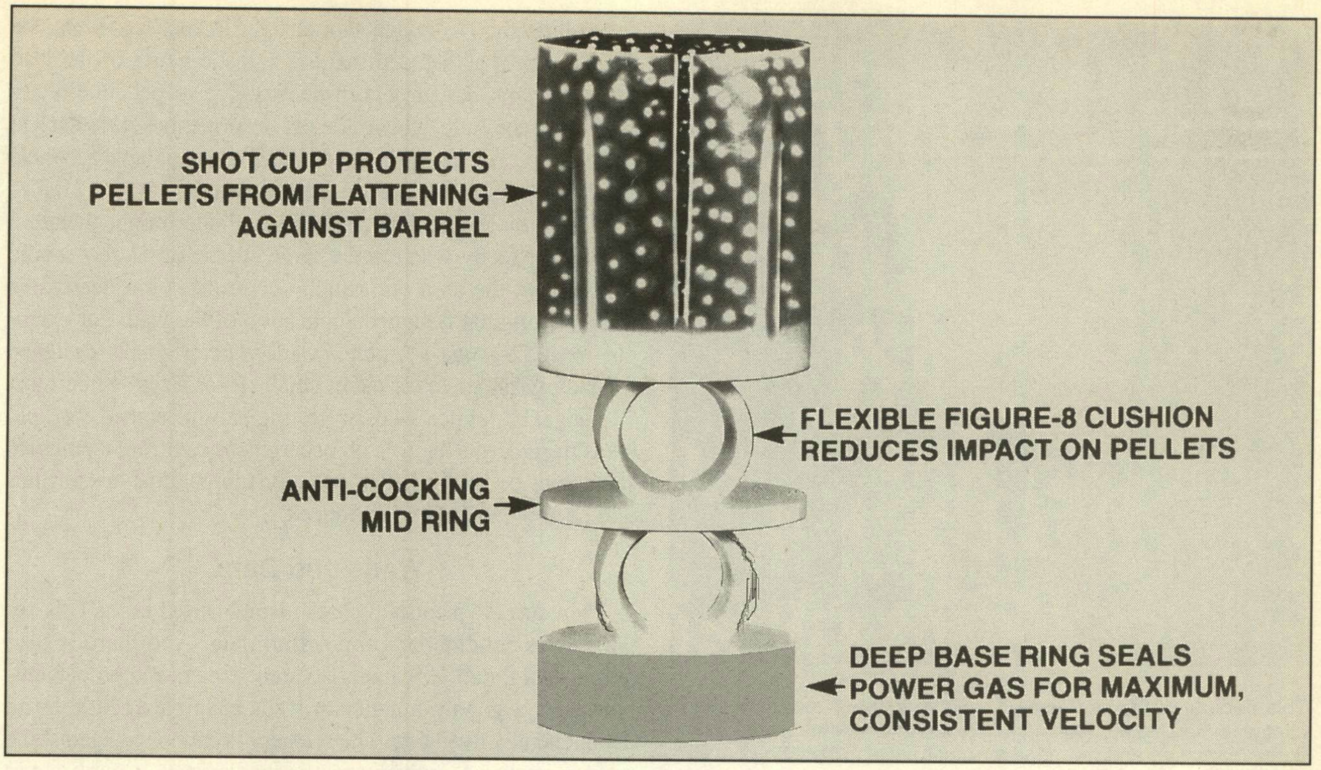


The wad plays an important role in the ballistics obtained and the uniformity of those ballistics. The reloader must select wisely and use only the specific wad listed in the data source.

SHOTSHELL WADS have come a long way since the use of card over-powder wads and fiber or cork filler wads. Today's low-density polyethylene one-piece wad column efficiently accomplishes several important ballistic functions. But it is this same diversity that makes each wad distinct in terms of pressures produced and the data used.

Gas Sealing

The primary purpose of the wad is to effectively seal off the gas behind it. If gas escapes past the wad, the velocity and pressure of individual shots will vary notably. The older-type card, even the cup-shaped cardboard over-powder wads, were not very efficient in terms of shot uniformity or the level of ballistics obtained from a specific powder charge. In contrast, the cup-shaped bottom of a modern wad obturates as chamber pressure rises, the cup expanding outwardly tightly sealing off the combustion process behind it. There is no leakage of gas detrimental to uniform ballistics or shot patterns. As a result, less powder is needed to achieve the same expected ballistics.



Shotshell wads vary considerably in ballistic performance, but all modern wads have an obturating over-powder cup, a collapsible leg section, and a shot insulating container section.

Combustion Chamber Size Control

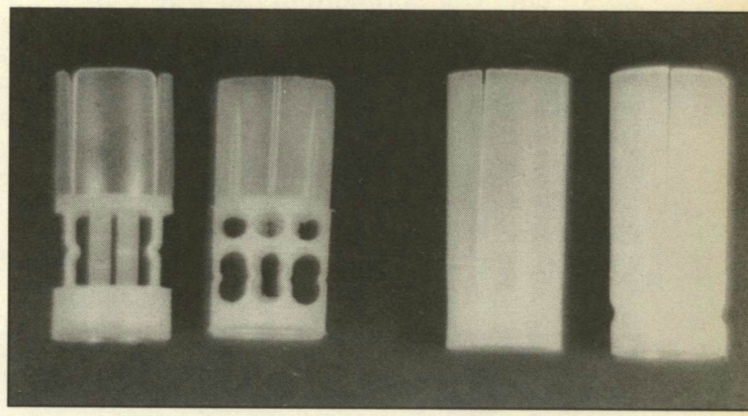
Modern wads differ from one another in construction. They have a base, a leg section and a shotcup. But the leg section differs from wad to wad. As powder burns and pressure begins to rise, the legs collapse, thereby enlarging the combustion chamber area and preventing pressure from rising too quickly. The rate at which the legs collapse varies from one wad design to another and results in performance differences with otherwise identical components. Wad design then will affect propellant charges used in the load.

Pellet Protection

A one-piece plastic wad protects lead pellets from deformation in two ways. First, the legs cushion the shot charge from violent acceleration which can cause rapid setback of the shot column and result in pellets crushing each other. As the legs progressively collapse, the shot charge is accelerated less violently, resulting in rounder shot, hence, better patterns.

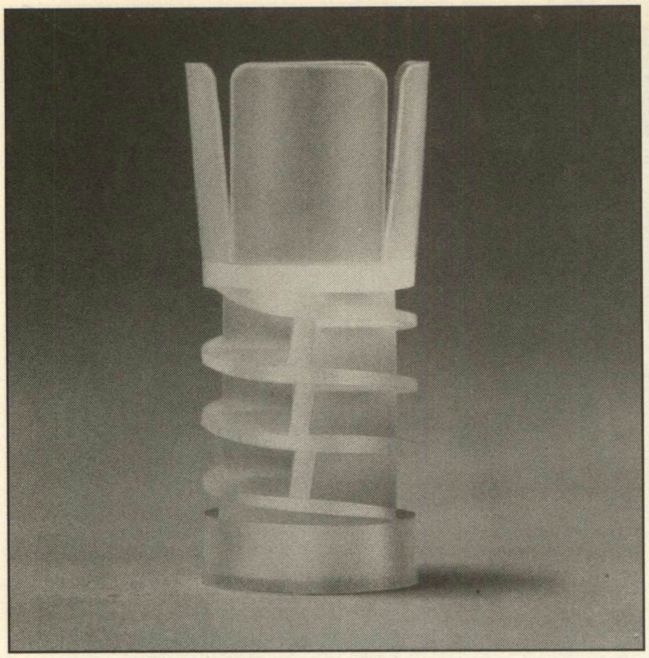
Second, the shotcup insulates the shot column from direct contact with the bore. This not only protects the bore of the shotgun, but keeps pellets from "scrubbing" on the bearing surface of the bore and being flattened. Insulated pellets remain rounder and the pattern density is improved at a notable level.

Steel shot wads differ considerably from those intended for lead shot. Most often they are made of high density polyethylene with very thick shotcup petals. This extra toughness and thickness prevents scrub-through as the hard steel pellets pass through the bore and forcing cone. A shotgun barrel will be quickly ruined due to scoring if steel shot wads are not used with such loads.



The wads on the left are lead shot wads (a Winchester AA type on the extreme left and a Remington Power Piston). Those on the right are two steel shot wads made of a thicker, tougher plastic and having no collapsible leg section.

Another difference between steel and lead shot wads is the lack of collapsible legs. The low density of steel pellets demands a larger volume of shot than a similar charge using lead shot. By doing away with the leg section, the much needed case space is made available for the higher volume steel pellet load. This does not affect the patterns. Steel pellets are extremely hard and simply do not deform due to setback or bore passage. However, it does affect the way pressures are generated in the shotshell chamber. Therefore, steel shot loads require a serious change in the type and quantity of propellant used for a specific shot charge weight. **Caution:** *Never use lead shot wads with steel shot and never use steel shot wads with lead shot.*



This Federal 12SO wad uses a unique spiral shaped leg with a central reinforcing rib. Wads are very specific with respect to ballistic performance, and the reloader must never substitute one wad for another.

Pellet Containment in the Wad Cup

Lead pellet charges will generally fit entirely within the shotcup of a wad. However, if a few rows of shot protrude beyond the mouth of the cup, there is no reason for concern. The "setback" that occurs at ignition will compress those rows of pellets back into the confines of the cup.

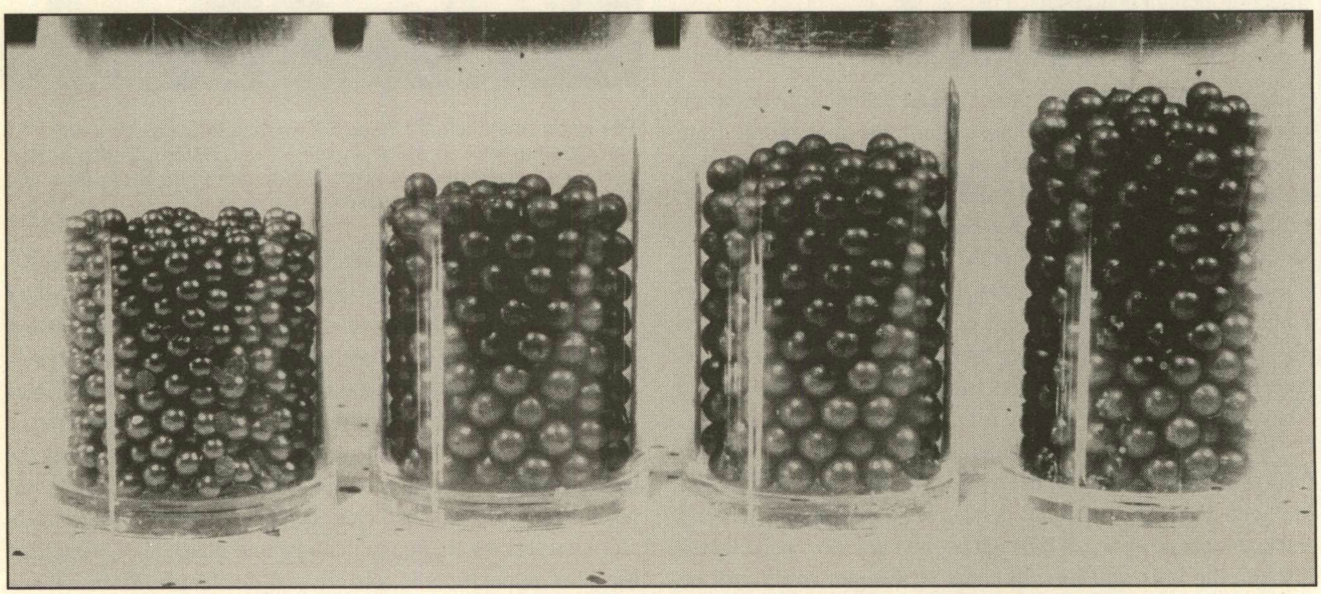
Some data purposely specifies shot charges which exceed shotcup size. One common example is a load using the Winchester WAA12R wad (designed for $1^1/_8$ ounces of shot) and calling for $1^1/_2$-ounce shot charge. In such instances, the data supplier has decided that the ballistic worth of the load overrides any loss in pattern density due to pellets directly contacting the bore. This trade-off is sometimes necessary to produce specific loads, as the reloader does not have access to all of the components used in factory loads.

It is possible that a $1^1/_8$-ounce of #9 shot might fit into a shotcup perfectly whereas the same charge of #2 shot would extend past the shot cup. Such occurrences are dependent upon the original designed application of the wad. For example, most 12-gauge $1^1/_8$-ounce wads were originally designed for factory target loads using small pellet sizes; while most 12-gauge $1^1/_4$-ounce wads were originally designed for field loads using larger shot. Such occurrences can from a practical standpoint be ignored. The variations in patterns or ballistics will be so small as to go unnoticed.

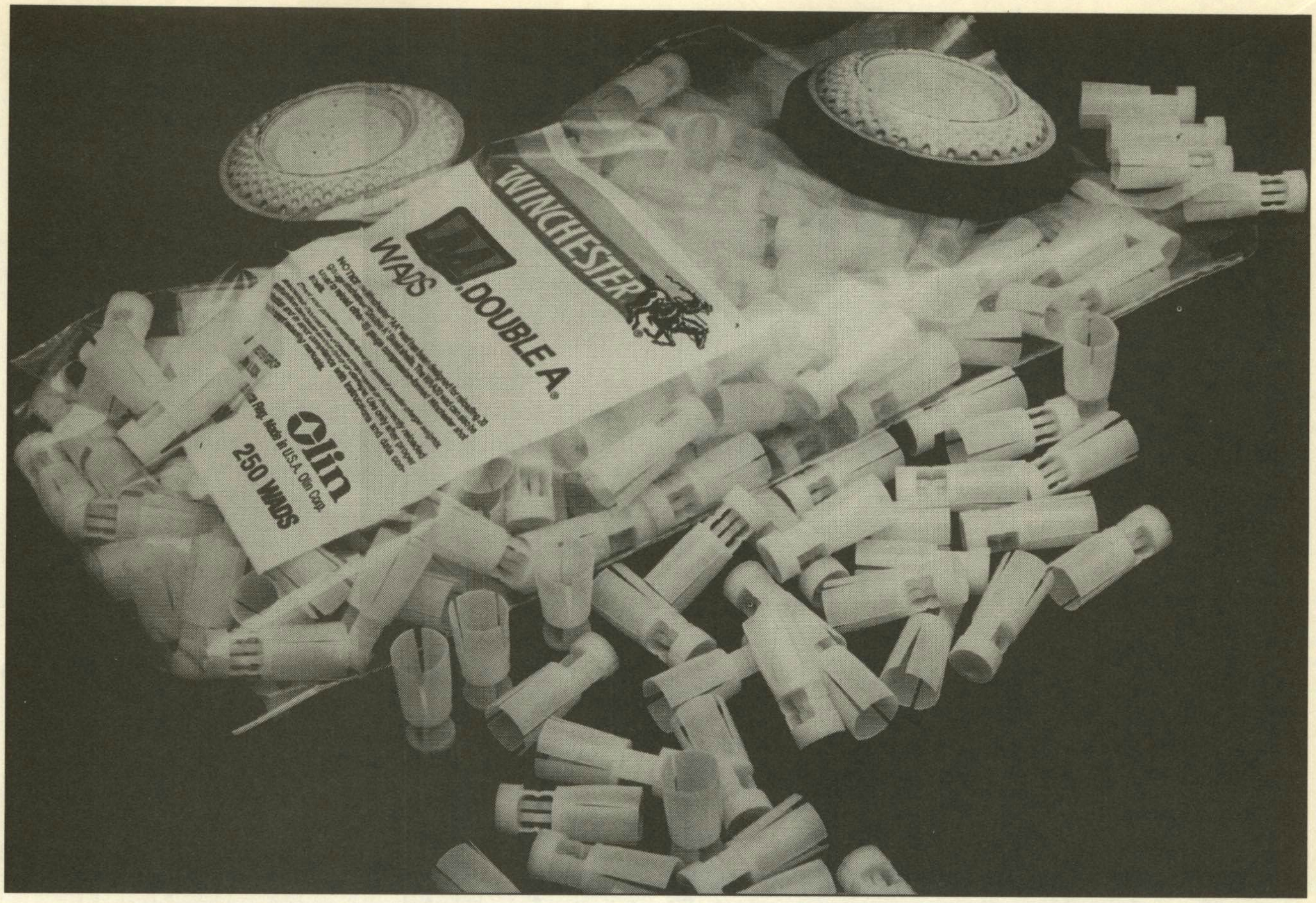
Wads and Data

There are few shotshell cases manufactured in the U.S. for which the handloader cannot find data. And there is also ample data for all U.S. manufactured primers and propellants. However, a goodly number of wads have either little or no data generally available. The reloader is cautioned against the use of any wad for which specific loading data is not listed in a reliable source. Directions which state that a Brand X wad can be loaded using Brand Z data could cause potentially serious load problems. Wads are just as specific in data requirements as are cases, primers and propellants.

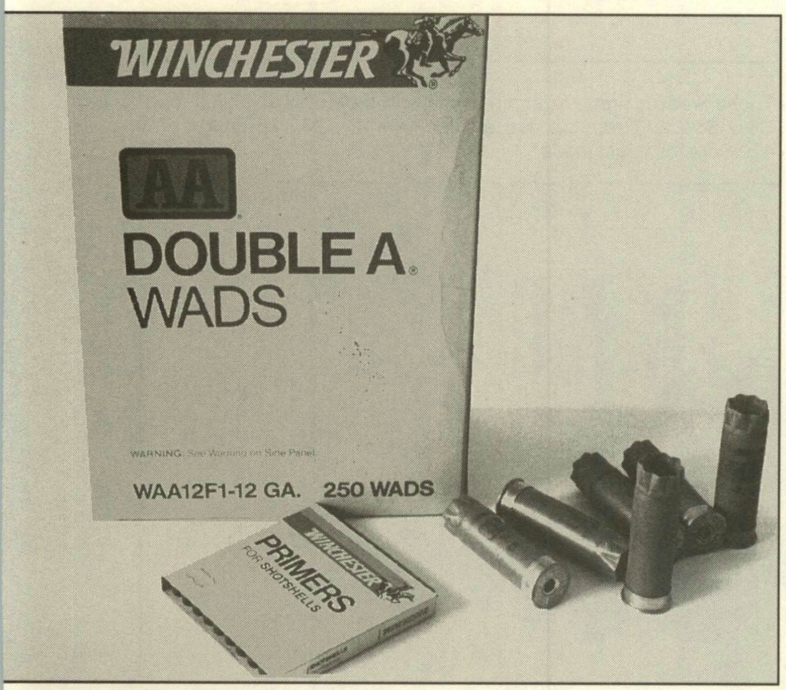
Warning: Never use any wad (or other component) without specific and reliable data. Wads are unique and each has a certain set of ballistic characteristics. While some data may suggest that in a specific set of circumstances different wads behave quite alike, a seemingly minor change in loading specifications could drastically alter one wad's performance as compared with another.



Differing weights of shot require differing volumes. Thus, loading several shot charge weights may demand you use different wads.



In some gauges, the choice of wads is extremely limited. For instance, the 16-gauge reloader may find it difficult to locate the pictured Winchester wad or the only other generally produced wad in this gauge, the Remington Power Piston.



Matching components is an easy way for the novice to avoid potential confusion. For example, if loading Winchester AA cases, simply select Winchester primers and AA wads.

Wad Performance

Wads vary in performance. For example, some perform flawlessly until the ambient temperature becomes very low. Then, perhaps at 0 degrees, the wad cup may fracture or fail to expand fully. Naturally ballistic uniformity will then suffer. The wads from ammunition companies and some responsible component suppliers are often free of such characteristics. Choose the best wad you can. Saving a penny or two per load makes little sense if performance becomes iffy. The alert shooter will learn to pick out changes in recoil or sound that indicate varying wad performance. When such signals are detected, it might be wise to switch wads—of course, adjusting all other data as required.

Wad Seating

Wads must be seated without damaging the over-powder obturating lip. If the cup's lip is split, cracked or torn, ballistic performance will suffer. Make sure your wad guide does not have any damaged or missing fingers and watch for torn or split case mouths which can cut or nick the wad base during the seating operation.

No air space should exist between wad and powder. Use a minimum of 20 pounds of seating pressure. Wad pressure may be increased to as much as 100 pounds in order to form a

Ballistic Products, Inc., is able to supply a wide variety of shotshell reloading items, including a wide array of wads for both lead and steel shot. The BP12 Shotcup (left) is for both $2^3/_4$-inch and 3-inch shells; BPD-10 (center) is for extended range shooting; and the Turkey Ranger is designed for magnum loads of plated lead shot.

good crimp. Heavier wad pressures may partially pre-collapse wad legs. If you find you must use excessive pressure to form a good crimp, you may be using the incorrect wad for the load. Wad selection must always be in accordance to reliable published data.

Do not use wads that are deformed, incompletely formed, or damaged in any way. Wads are manufactured by the millions, and it is impossible for the manufacturer to inspect 100 percent of them. So the burden rests on the reloader to examine each wad as it is used to ensure suitability.

Wad Storage

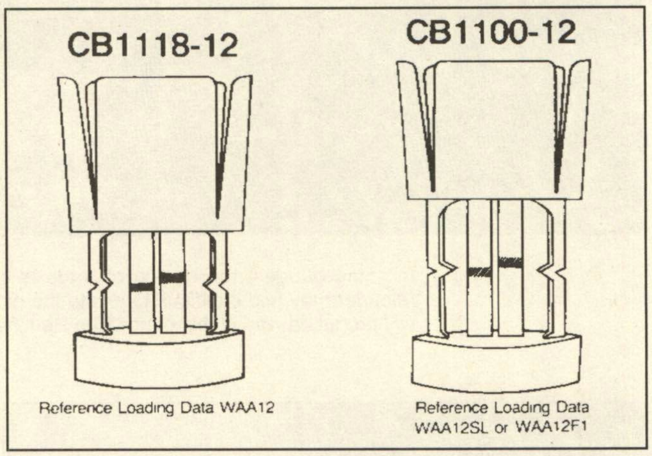
Wads are fragile and easily damaged. If seated with petals bent inward, shot can become lodged between the wad and case wall. At best this will result in deformed pellets and poor patterns. At worst, it can cause an undesirable change in internal ballistics. Correctly seated, the petals should be flush against the inside walls of the case. As you're reloading, stay alert and simply bend bent wad petals back into position.

To save yourself time while reloading and grief in the field or range, simply remember not to store bags of wads one on top of the other.

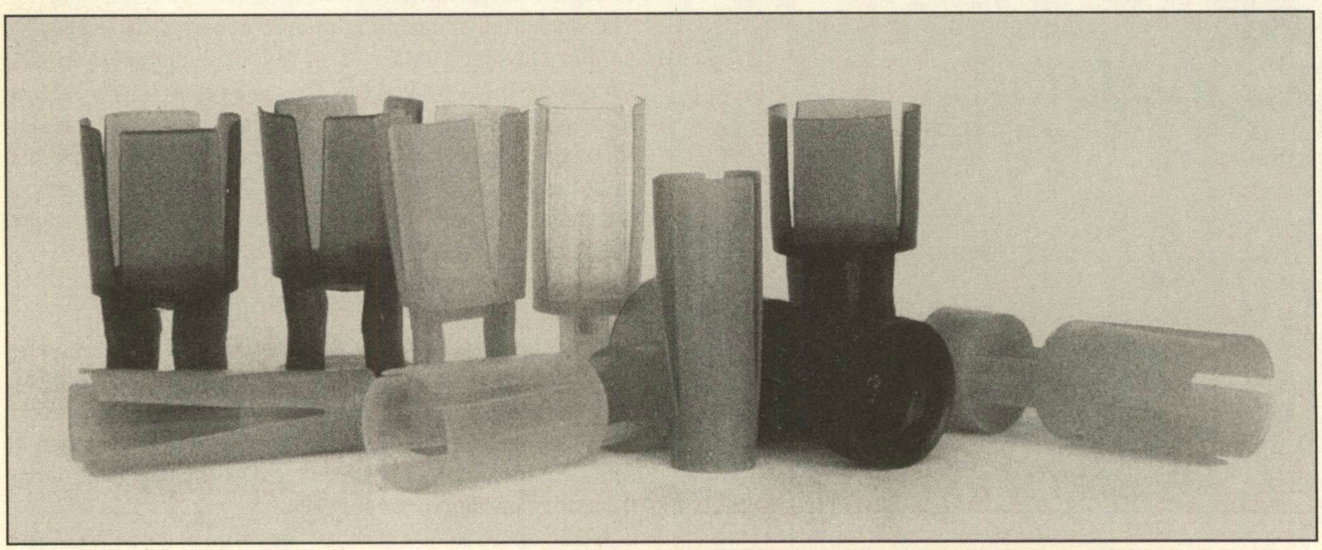
Wad Selection

In certain applications, wad choice is severely limited. For example, if you load 16-gauge shells, you may find only the single Winchester or Remington wad available in local outlets.

In popular applications such as 12- or 20-gauge, wad selection might appear overwhelming when looking over data listings. To keep things simple in the beginning, select wads on a brand matching basis. If you are loading a Federal Gold Medal target case with a Federal 209 primer, then also select a Federal wad. In fact, it is often possible to use the exact same wad and primer as in your favorite factory load. As time passes and experience is gained, you will be able to determine if other wads might be more advantageous.



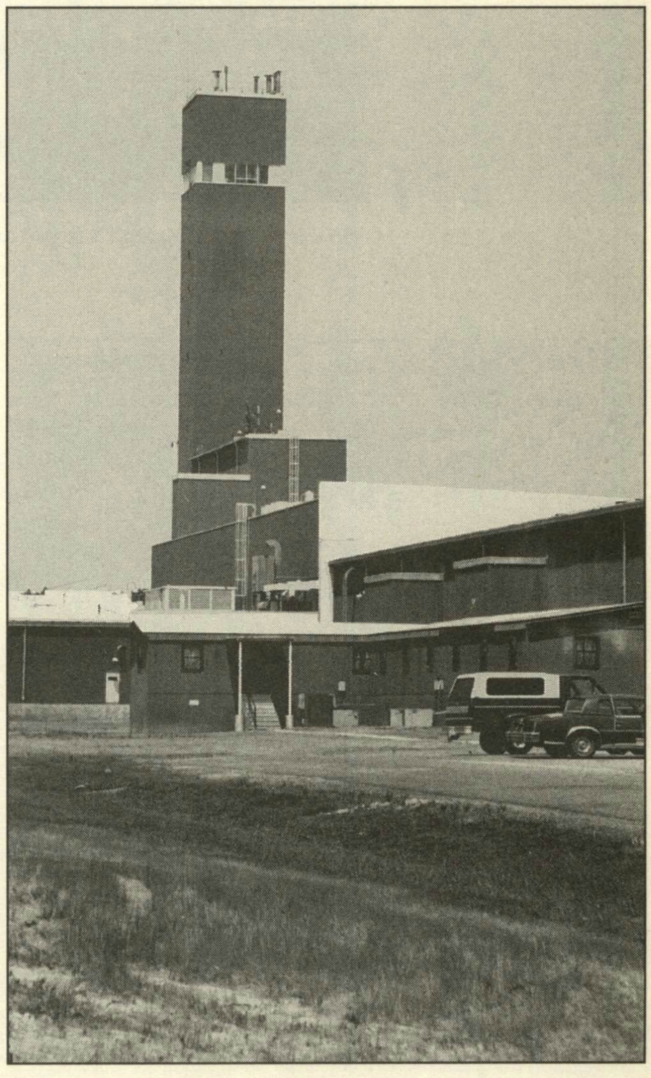
These wad designs, in straight-wall and tapered-wall styles from C&D Special Products, are available in 12-, 20-, 28-gauge and 410-bore for target loads..



Pattern Control makes these wads in 12 ($1^1/_8$, 1 oz.), 20 ($^7/_8$-oz.), 28 ($^3/_4$-oz.) and 410 ($^1/_2$-oz.) in seven styles for Skeet, trap and field loads.

CHAPTER 10

Shot—Selection, Types And Charging

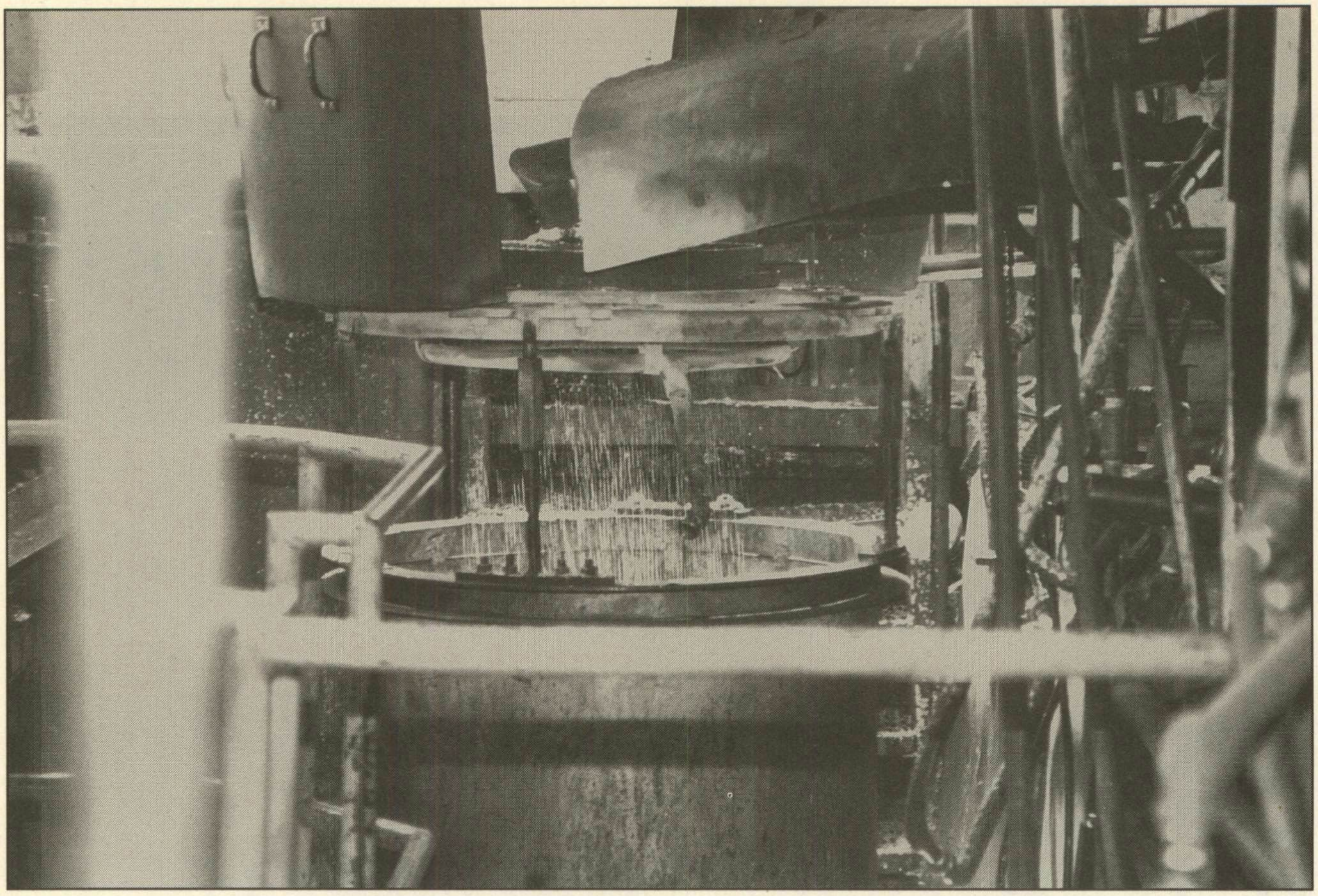


This is Remington's shot tower at their Arkansas ammunition factory. Such towers produce the very best quality shot.

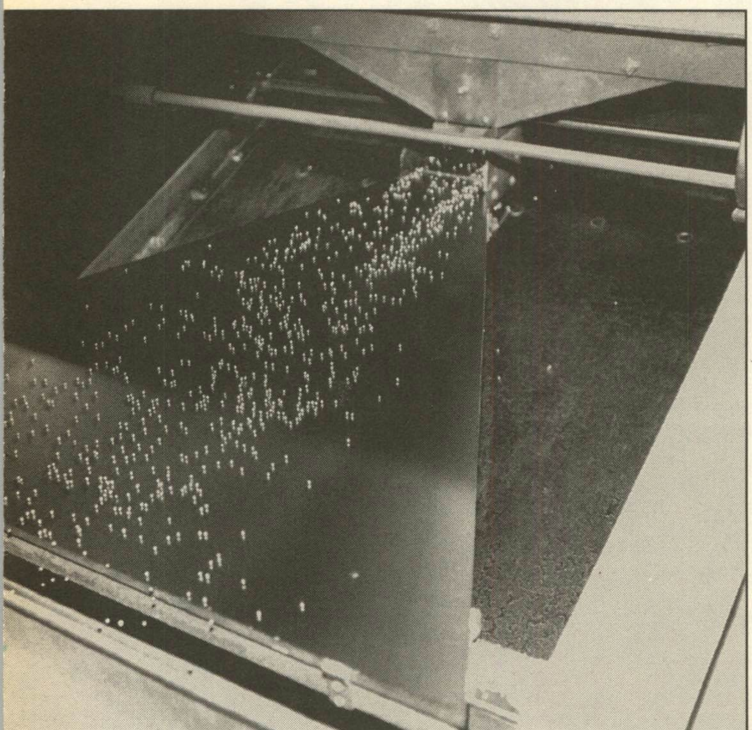
COMMERCIAL SHOT IS manufactured in two general ways. One method involves pouring molten lead onto spinning plates to form the lead droplets, which works but does not produce the roundest or highest quality shot. The second and best method is to pour molten lead from high towers through screens. The screens help control the size of the lead droplets as they pass through the screen grid. Then, as the teardrop-shaped droplets fall through the air, surface tension forms them into spheres. The lead, at this point, is still quite hot and soft, so the pellets fall into a liquid cooling bath at the base of the tower to prevent deformation.

The shot is then carried back up the tower and allowed to roll down a series of plates. The perfectly round shot passes down the plates and into bins; the less-than-perfect spheres wiggle off the sides of the plates and are reprocessed.

The shot is then coated with graphite for better flow-through in loading machines and protection against pellet oxidation. Some shot may be plated with nickel or copper instead of the graphite.



Molten lead is poured through a droplet-forming and sizing screen in the shot tower.



This is newly formed shot rolling down inclined plates which separate the less than perfectly formed pellets from the most round spheres.

Homemade Shot

From time to time, some enterprising folks have offered shot-making equipment for the hobbyist. These have not met with general acceptance, perhaps because some failed miserably at the task. They seemed to be most popular when shot was selling at a very high price.

At least a few units did make usable shot. One of these, the Littleton shot maker was actually quite good. While the fate of the Littleton outfit is currently unknown (they have not responded to letters sent to their last-known California address), there may still be some units floating around. I used one to produce several hundred pounds of shot, then passed it on to a son of a friend who lived in the West. Over the past eight or so years, he has made several tons of useful shot with it.

The Littleton setup included a heater to melt the lead and a spout which allowed the liquefied lead to fall free as droplets. The size of the spout orifice controlled pellet size. Droplets fell into a tank of oil for solidification and as the tank filled, the displaced oil spilled over the top into a recovery trough and was then drained into a capture tank.

Shot was then spilled onto a screen to sort out the small incomplete shot (fines), the oil washed away and the shot graphited. Pellets made with the Littleton system were not true spheres, but they were of sufficient quality to use for informal Skeet practice or non-demanding hunting.

Shot Types

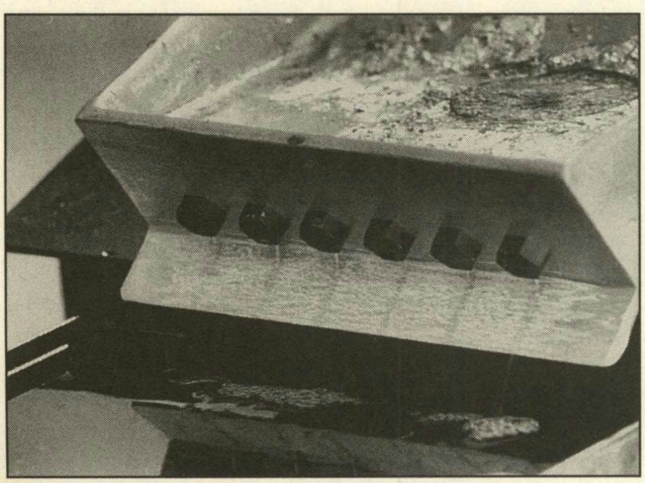
SHOTgun, SHOTshell, SHOTshell reloading; in each word(s) SHOT commands prominence. Despite this, shotshell reloaders do not always give shot sufficient thought when selecting this often misunderstood component. All shot are not created equal.

Shot is made in three basic degrees of hardness. Soft shot (also called drop shot) is of pure, or almost so, lead. As a result, it is the densest and requires the fewest number of pellets per a given charge weight. Because soft shot is easily deformed as it passes through forcing cone, barrel, and choke, the pellets tend to disperse rapidly. This is an advantage for short-range shooting where the widest possible pattern is always an asset. But for medium- to long-range shooting, patterns can be excessively large and insufficiently dense for the multiple hits required to make clean kills.

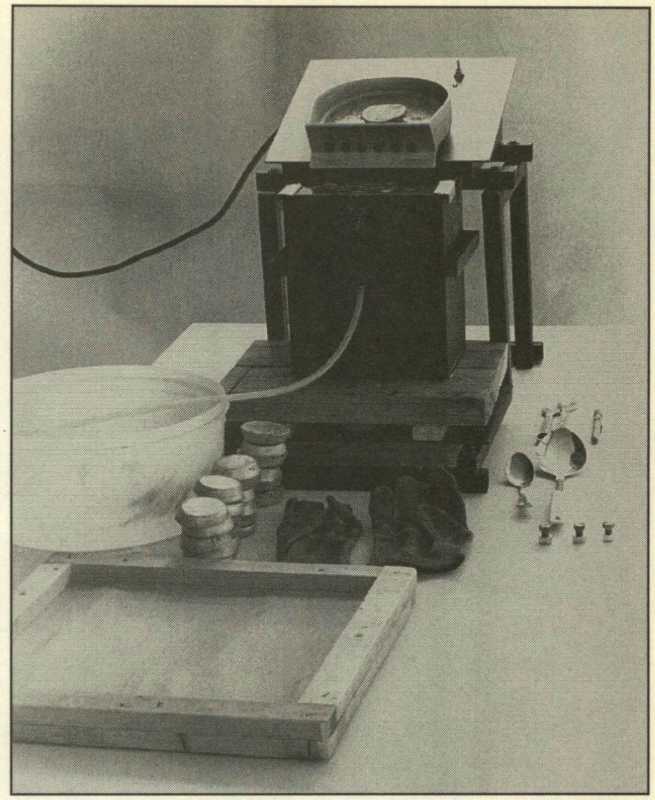
Next comes hard shot, also called chilled or field-grade shot. Hard shot contains an alloying metal, usually antimony, as the hardening agent in a range of 0.5 to 2.0 percent. The increased hardness results in shot that is less likely to deform and disperse rapidly, resulting in denser patterns at medium and long ranges. Because of the decreased density, there are more pellets to a given shot charge weight and thus a small, but nevertheless real, increase in pattern density. Most factory field loads use hard shot.

Extra hard shot, sometimes called target-grade or magnum shot, contains from 3 to 6 percent of alloying metal, again usually antimony. The advantages are that it leaves the muzzle with a minimum of deformity and provides the highest possible pellet count per given shot charge weight. This results in maximum pattern density at long ranges. Extra hard shot is used in many factory premium-grade loads and almost all top-quality target loads. You will be unable to duplicate the pattern density of these factory loads unless you use extra hard shot.

Hard shot and extra hard shot are available plated, usually with copper and sometimes nickel. Plating slightly enhances resistance to in-barrel deformation and thereby provides a small degree of improvement in pattern density. Plated extra hard shot is found in many factory premium-grade loads. Still, the performance differences between plated versus non-plated shot are so small as to make it less than practical for the reloader to pay the extra cost of plated pellets.



This is a close-up of the lead droplets escaping from a Littleton shot maker and falling into the oil bath to harden the pellets.



The Littleton shot maker was a unit that enabled the reloader to make acceptable shot for modest applications.

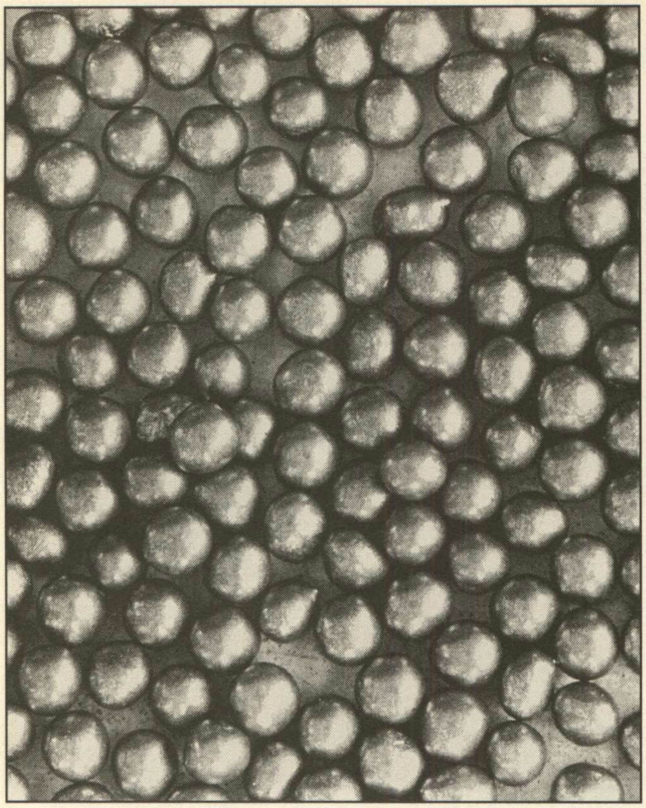
Shot Size

After deciding which shot hardness is appropriate for your shooting needs and budget (each increase in hardness results in an increased cost), you must select from among the half-dozen or so generally available shot sizes ranging from #9 (small) to #2 (large), or perhaps even the 18-caliber BB. Often, the reloader selects a size unsuitable for the intended game or target application. Over the last three decades it has become increasingly popular to look upon #7$^1/_2$ shot as a panacea for all shooting situations. Perhaps this is due to misinterpretation of articles published on the subject; or data that were based on less than extensive experience.

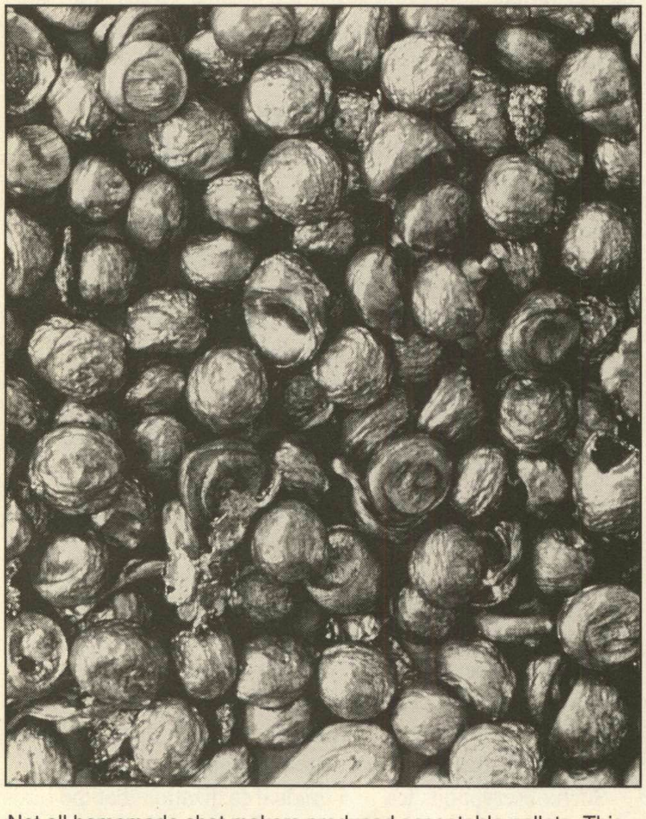
Years ago, I had the opportunity to raise approximately a thousand pheasants each year for five years. Birds were bought as chicks and raised to maturity. All were released for myself and others to hunt. I was present when all but a few of those birds were shot, or shot at.

I learned to detect hits that went unseen by others: a dropped foot, a missed wing beat or two, a head twist. I began to realize that birds were being hit but many escaped; even birds that were well "feathered" managed to fly or glide out of sight.

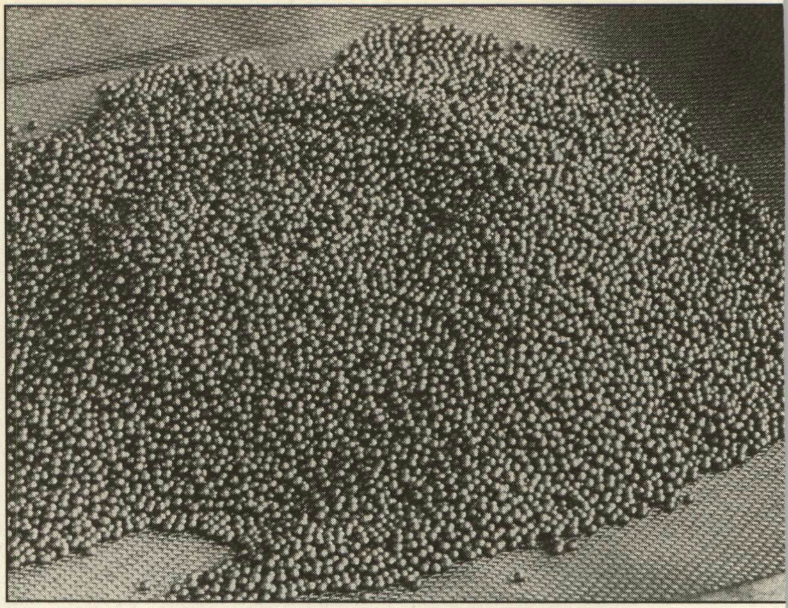
Such observations led to a gradual realization that the birds were not being clobbered hard enough. Yes, folks who used 1-ounce of #7$^1/_2$ shot from a 20- gauge did put birds in the



A close-up of the pellets formed with a Littleton shot maker. Not bad for modest applications such as informal Skeet practice.



Not all homemade shot makers produced acceptable pellets. This mess was made on a unit that helped give home shot making a very bad name.



Homemade shot has to be screened, washed and graphited before use.

oven. But, as a whole, large numbers of pheasant simply became fox fodder. So, I began rather extensive field research for a suitable and highly efficient load that would bag most of the birds that were hit.

With the total cooperation of my clients, we experimented first with shot sizes. Number $7^1/_2$, #6 and #5 shot were tried in ascending order for a year. Each increase in size showed improved performance. Having been brainwashed at an early age to use #$7^1/_2$ shot for all upland hunting, I was reluctant to go any larger than #5 shot. Thus, increases in shot weight charges with each of the three sizes consumed the third season's shooting.

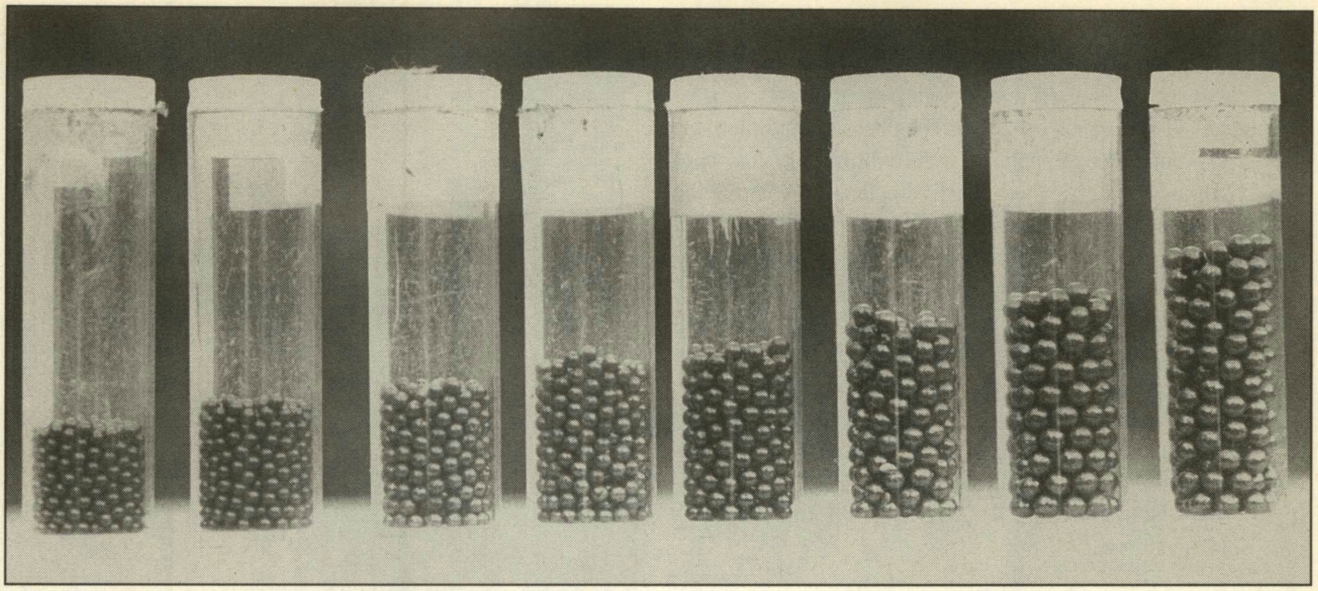
At the end of the third season, the ideal load had yet to be found—some hits still resulted in fly-aways. Lessened but persistent telltale signs of hits with little reaction from the pheasants continued.

Season four was started with a drastic change in the ammo I shot and supplied my clients. All used only #4 shot in $1^1/_4$, $1^3/_8$ and $1^1/_2$ ounces. I wanted to know if "duck" loads would work or if they were even appropriate for pheasants.

Obvious and impressive results began to show almost immediately. The number of hits resulting in fly-aways all but disappeared, and the rare few occurred only at very long ranges.

Despite all the printed words to the contrary, five years of testing on almost 5000 birds proved that the best load for pheasants was $1^1/_2$ ounces of #4s at the usual short magnum velocity of 1260 fps. The $1^1/_4$- and $1^3/_8$-ounce loads both worked so well as to make the difference almost indiscernible. Quite a few birds, indeed thousands, were killed with the lesser loads, but the heavy shot charges of #4s proved most effective.

The bottom line is not to overlook larger pellets and heavier shot charges when your hits are resulting in more than a rare lost cripple.



Shot comes in a number of sizes. As pellet size is increased, the shot charge weight must be increased to maintain sufficient pellet count for proper pattern density. Each of these containers have identical numbers of pellets which range in size from #9, through #8$^1/_2$, #8, #7$^1/_2$, #6, #5, #4, and #2.

Shot Velocity and Energy

A load traveling at 1200 fps is less effective on game than one at 1300 fps at longer ranges because increased velocity means increased energy and momentum. This, in turn, boosts a pellet's ability to penetrate. Herein lies the secret to success of the #4 pellets on pheasant. A heavier pellet started at the same velocity always has more energy than a lighter pellet and will penetrate deeper ensuring vital organs are struck, especially as ranges become longer.

Larger shot and higher energy levels often result in complete penetration of the quarry, leaving no lead pellets to worry about at the table. The only disadvantage is if pattern density becomes too sparse for smaller game to receive the necessary multiple hits.

When cold temperatures force a drop in muzzle velocity, a shooter may find the pellet size that worked fine in warm weather fails when the thermometer drops 40 degrees or more. The point is, again, that selecting the largest practical shot size will enhance game bagging ability. **Caution:** *Large pellets travel farther and retain higher energy levels. Thus they represent an increased hazard with respect to an accidental shooting of another. Always be certain of your backstop. Even a single pellet can cause serious or lethal injury.*

Shot Size Suggestions

Table I lists pellet sizes that most often provide clean, one-shot kills. This guide will help prevent cripples or the escape of wounded game. The pellet sizes suggested are large enough to provide the necessary energy to penetrate to the vitals, while still maintaining sufficient pattern density to achieve the four or five hits needed to kill cleanly.

Of course, there are shot sizes other than those shown in the Shot-Size Guide. These would include B, #1, #3, #5, #7, #8$^1/_2$ and #11. However, these will be extremely hard to find in most retail shops. When available, they will allow the reloader to refine shot size selection to best suit actual needs. For example, some Sporting Clays shooters favor #8$^1/_2$ shot. Remember that no table can anticipate all field conditions. Varying range requirements or shooting styles can often result in a need to go up, or down, one, or perhaps two, shot sizes from those listed in the table. No table can replace actual field experience.

SHOT SIZES
(Shown Actual Size)

Lead Shot No.	Dia.	Buckshot	Dia.
9	.08″	4	.24″
8½	.085″		
8	.09″	3	.25″
7½	.095″		
7	.10″	1	.30″
6	.11″		
5	.12″	0	.32″
4	.13″		
2	.15″	00	.33″
Air Rifle	.175″		
BB	.18″		

Shot pellets shown actual size.

Shot Charge Weight

Depending on shot size chosen, there is a minimum charge weight that should be used if sufficient pattern density is to be maintained. If you select #4 pellets for pheasant and then use only a $^{7}/_{8}$-ounce charge, patterns will exhibit very low shot density. It has been estimated that five pellets must strike the quarry to ensure the probability that one or more will hit a vital organ. Thus, there are minimum shot charge weights to consider with the shot size selection as shown in Table I, page 80.

It is not always possible to match the game to an ideal shot size and charge weight if a small-gauge gun is being used. In this case, the conscientious shooter will keep ranges very short.

Cost effectiveness lessens if a heavier than needed shot charge weight is used. Considering $1^{1}/_{8}$ ounces of shot as nominal, the following cost factors apply: $^{7}/_{8}$-oz.— 22% savings; 1-oz.— 11% savings; $1^{1}/_{4}$ ozs.— 11% increase; $1^{1}/_{2}$ ozs.— 34% increase.

Pellet Range

Pellet size and velocity play important roles in determining maximum practical shooting range of your reloads. Assuming you match pellet size to game size, the maximum ranges for various pellet sizes are shown (along with a suggested minimum muzzle velocity) in Table II page 80.

Pellet Count Per Charge and Pellet Hardness

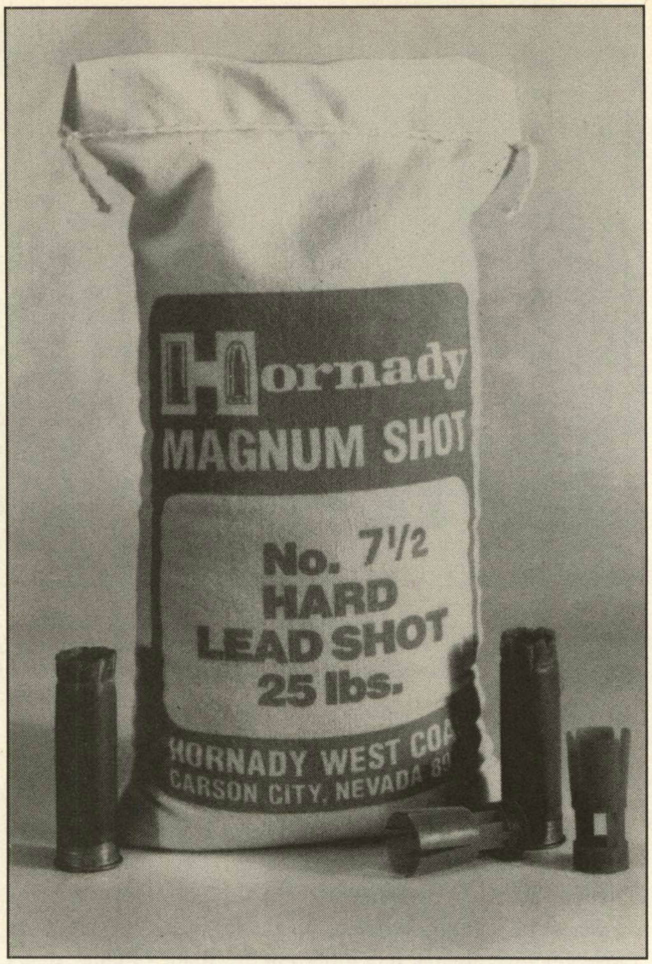
To determine the pellet count for a given load, simply multiply your shot charge weight (in ounces) by the following factors (the number of pellets in 1-ounce for each shot size of hard shot): BB/50; #2/87; #4/135; #5/170; #6/225; #7$^{1}/_{2}$/350; #8/450; and #9/585.

Hardness of the shot alloy effects pellet count for a given charge weight. And the amount of alloying metal used varies depending on pellet size. For hard shot, the proportion of antimony ranges from 0.5 percent in #2 shot to 2.0 percent in the smaller pellet sizes. Extra hard shot uses 2 percent antimony for BB and #2, 3 percent antimony for #4s and #5s; 4 percent for #6s and #9s; with the hardest alloy — 6 percent antimony — reserved for #7$^{1}/_{2}$s and #8s. This extra hard alloy is used in trap loads.

The shooter's range requirements should dictate shot hardness selection. The longest ranges demand the tightest patterns and the hardest shot. The very short-range shooter may find soft shot is all that is needed. The final proof of pattern density can be best determined by the firing of a few patterns on a test target which has a game outline drawn on it.

Shot Quality

Shot is supposed to be round. Experience shows that some brands universally tend to be quite round, while others have a percentage of noticeably distorted pellets. Test your shot by spilling some on a flat surface to get a feel for quality. All brands will have a few misshapen pellets, but easily detected quantities are an indication of less than perfect quality control. Buy the best quality shot you can afford; reloads perform more efficiently with top-notch components.



Shot is available from a number of sources which include ammunition manufacturers as well as specialty houses.

Spreader Loads

Interest and use of spreader loads, loads that spread patterns to a maximum as quickly as possible, wane and peak in cycles, and seem to match the shooter's ability as a marksman.

Successful shotgunning remains dependent on the gunner's ability and the correct choice of choke, shot size and shot charge weight. Naturally, for best results, short ranges demand open chokes, i.e. Cylinder, Skeet, and Improved Cylinder. Shot sizes and charge weights must be carefully matched to the range and game being hunted. The good shot with an open choke and appropriate load will make the most of short-range opportunities and hunting conditions. Chokes are covered in more detail in Chapters 12 and 13.

Taking very short-range shots increases the high probability of extensive meat damage. Switching to a lighter shot charge weight, a larger size shot, or both, eliminates or reduces this problem by diminishing pattern density and thus reducing the number of pellets striking the game.

Nonetheless, a load spreading its effective pattern quickly enables the shooter to score a few short-range hits that might otherwise not have been made and reduce damage to the meat. Therefore, there are hunting conditions that call for the use of a spreader load.

It is a paradox that spreader loads provide the least change in pattern density when used with an open bore shotgun and the greatest change when fired through a relatively tight choke. Thus, spreader loads are best suited to tight-choked shotguns.

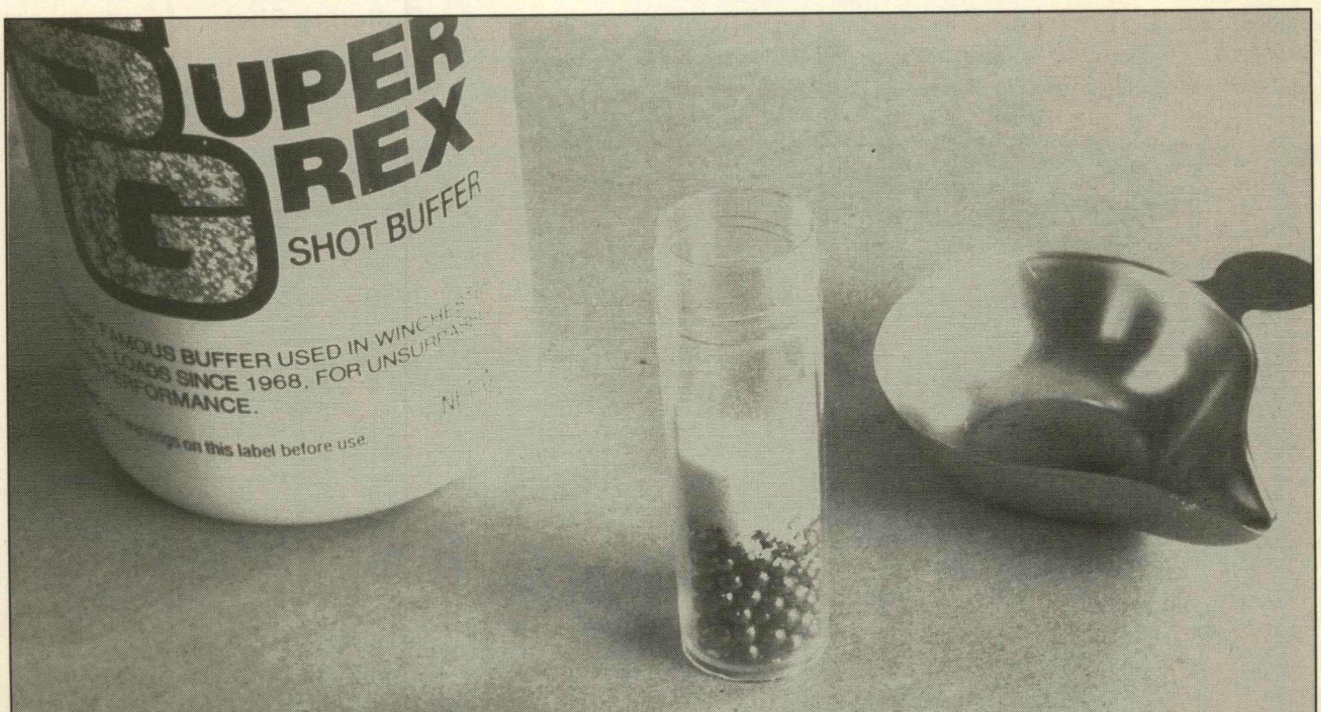
With properly loaded spreader ammo, patterns with a Full choke open to about Improved-Modified density. Patterns obtained with an Improved-Modified choke closely resemble those of Modified choke density and through a Modified choke seem to just about duplicate an Improved-Skeet (Skeet #2) density. There is almost no change in pattern density when Improved-Cylinder or Skeet chokes are used.

As assembled by the various ammo makers, the shot column of a spreader load is divided into several segregated units. This often involves only a simple "X" card insert dividing the shot into four columns. The reloader can duplicate this procedure with a homemade light cardboard "X" separator or purchase such wads from Ballistic Products. The weight of the shot charge must be reduced by the weight of the insert card to keep the data recipe safe.

Another method is to divide the charge into three equal layers using two thin over-shot card wads (0.070-inch). Again, the weight of the shot charge must be reduced by the weight of the card wads. In all cases, the divided shot charge must be weighed in individual increments and be placed into the case by hand.

A spreader load can also be duplicated by combining high velocity and soft shot. Soft or drop shot will incur a higher percentage of deformed pellets when the load is fired. Combine this characteristic with high velocity and shot deformity becomes even more pronounced during passage through forcing cone, bore and choke. With the rapid dispersion of the

Shot hardness affects pattern density. Use the specific shot appropriate to your use and indicated in your data if you want to bring home trophies like this.



Adding a buffering agent to the shot charge means the use of special data available only from the buffering manufacturer.

TABLE I

Hard Lead Shot-Size Guide				
Shot	Shot Size Dia. (ins.)	Shot Size Wgt. (grs.)	Min. Charge Wgt. (oz.)	Typical Application
BB	0.180	8.75	1 1/2	Large fur bearers.
#2	0.150	5.03	1 3/8	Turkey when safe and permitted, small fur bearers.
#4	0.130	3.24	1 1/4	Pheasant, squirrel, turkey, rabbit, etc.
#5	0.120	2.57	1 1/4	Pheasant, squirrel, turkey, rabbit, etc.
#6	0.110	1.94	1 1/8	Short-range pheasant, crow, grouse, dove, partridge, etc.
#7 1/2	0.095	1.25	1	Clay targets, woodcock, snipe, large rails, rabbit, quail, grouse, etc.
#8	0.090	1.07	1	Clay targets, quail, snipe, rails, woodcock, etc.
#9	0.080	0.75	7/8	Clay targets, quail, woodcock, snipe small rails, etc.

deformed pellets, patterns will be noticeably less dense and, therefore, wider.

In order to achieve a worthwhile spread, velocities must be in excess of 1350 fps. Obviously, this is not possible in all gauges or with all shot charge weights, but most 12-gauge 2 3/4-inch shells used with 1 or 1 1/8 ounces of shot will allow such velocities.

It is important to keep a practical relationship between total pellet count and game size. A charge of 1 1/8 ounces of #4s would not make a practical woodcock load. But careful pattern testing of your spreader loads just might show that the same shot charge of soft #6s at 1400 fps will do the job at very short ranges.

No spreader load should be used on game until at least ten patterns have been fired at the nominal range you expect to encounter in the field. When a satisfactory load has been developed, at least five patterns should be fired at the shortest and longest anticipated ranges, and adjustments to the load made if necessary. Depending on local hunting conditions, it may be wise to load only the first shot as a spreader load, follow-up rounds being conventional ammo. Or, if the cover dictates otherwise, two or more spreader loads may be loaded.

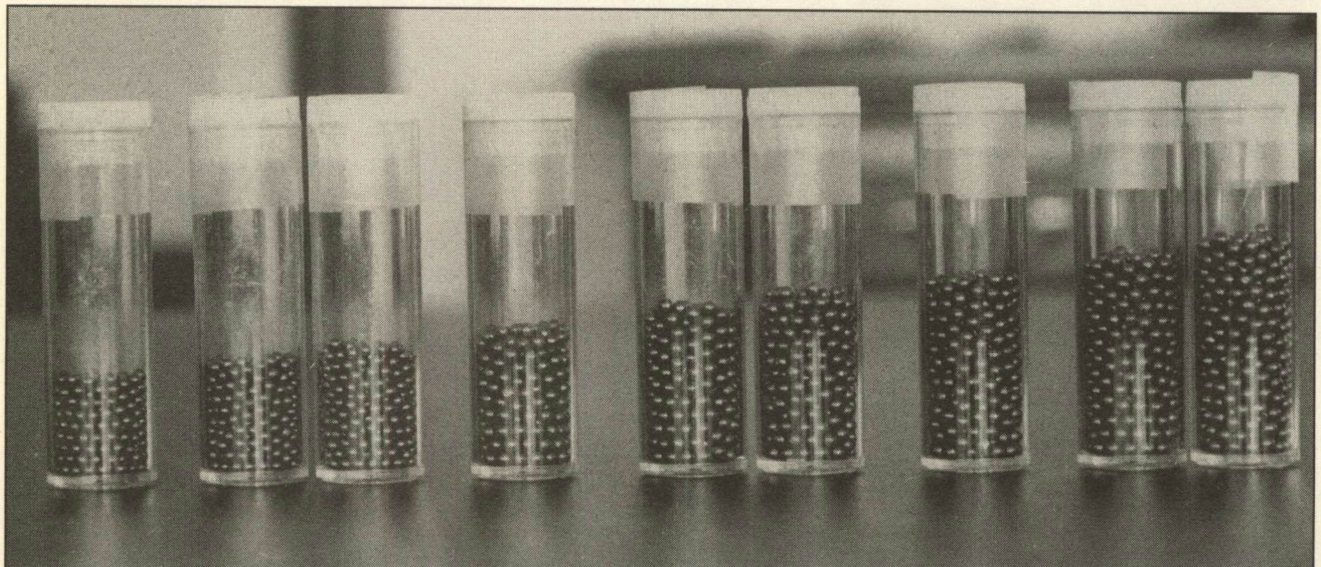
TABLE II

Maximum Practical Hunting Ranges			
Shot Size	Minimum Charge Wgt. (oz.)	Nominal Velocity (fps)	Maximum Range (yds.)
BB	1 1/2	1260	60
#2	1 3/8	1260	55
#4	1 1/4	1330	50
#6	1 1/8	1165	45
#7 1/2	1	1165	40
#9	7/8	1135	35

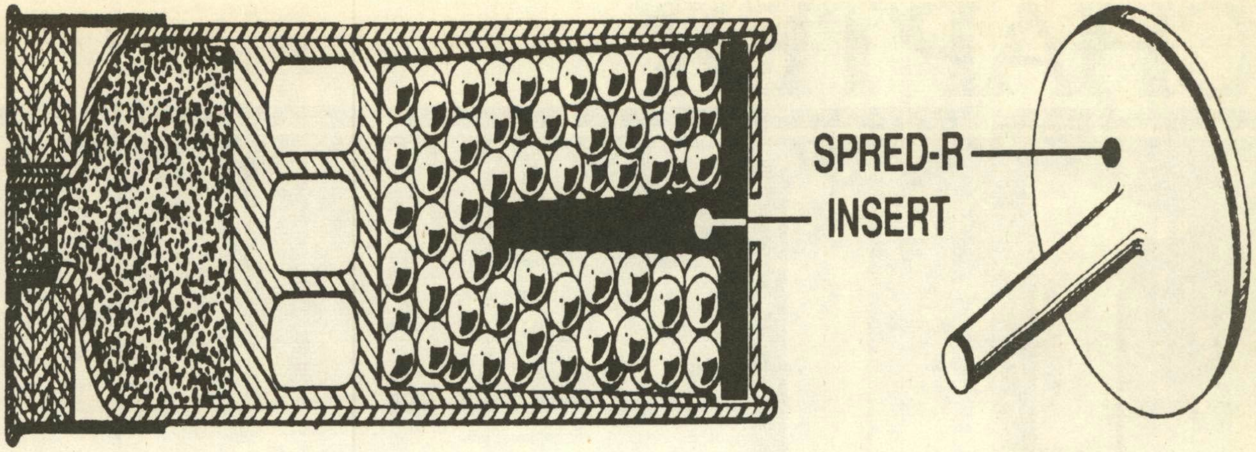
Expert marksmen will gain the least from spreader loads. Once having tried them, most average shooters quickly find that they are not needed for short-range shooting. But they can provide a small advantage that will slightly improve the fair gunner's chance of success at extremely close ranges.

Buffering Shot

Adding a buffering agent to a load may increase the density of shot patterns. Usually a granulated polyethylene, buffers



Taking the time to carefully consider the type, size and quantity of shot needed for the intended application is part of getting the most from shotshell reloads.



The Polywad Spred-R-Wad is a variation of the cardboard spreader. It's designed to open patterns from Full to Improved Cylinder and can be used with any wad and shot. Shaped like a thumbtack, it's inserted into the shot charge just before the crimp is applied.

greatly affect the fluid dynamics of shot's passage from case through forcing cone, barrel and choke. It also dramatically increases chamber pressures. Therefore, it is vital that specific data for the buffered load is on hand. Too, the buffering must be carefully weighed, added to the shot, properly mixed and then placed in the case. **Caution:** *All the data in this book is for non-buffered loads, unless otherwise specifically stated. Never use buffering with any of the non-buffered data contained herein. Contact the qualified buffer manufacturer for appropriate data.*

Charging Shot

Charging a case with shot demands the reloader verify the exact charge weight being thrown. A bushing or bar marked 1 1/8 ounces may throw that charge with number #9 shot, but as shot size increases the charge thrown will be less. Also, the bushing may have been made incorrectly or may have been mismarked or incorrectly packaged. Thus, shot charges must always be verified with a shot and powder scale.

Verification cannot be done by simply metering a single shot charge on the press. It must be done during an actual loading sequence and then at least ten charges must be weighed. For more on this refer to Chapter 13.

As shot size increases, the likelihood of shot bridging (jamming) in the shot drop tube increases. The reloader must stay alert for this problem. A partial charge of shot will result in a poor crimp. But if the remainder of the charge drops into the next case, it may be mixed with the propellant charge if the press has only one drop tube or dropped onto the next shot charge if there are separate drop tubes for powder and shot metering. Either causes a very dangerous condition.

Lightly tapping the drop tube will often free the occasional jam. If jamming occurs frequently, replacement of the lead shot drop tube with one designed for steel shot may cure the problem.

Shot type, size, charge weight and accuracy as well as the uniformity of the charge weight can make a big difference in shotshell reloading safety and performance. Spending a bit of time to make appropriate component and equipment selections can also pay big dividends with respect to your reload satisfaction.

CHAPTER 11

Crimps And Ballistics

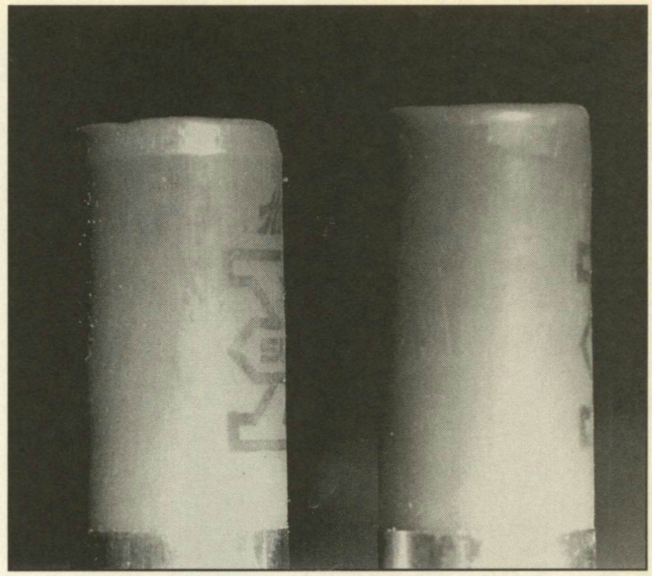
CRIMPS ARE OFTEN the one detail that sets the experienced and/or careful reloader apart from the inexperienced or careless reloader. The factory-like appearance, or lack thereof, of reloaded shotshell crimps reveals a great deal about the care given to reloads and the sophistication of the reloader.

Your crimp may spiral, as though the shell was rotated slightly as the case was folded and closed. This might suggest simply too much case material or the crimp not being deep enough—meaning the crimping die is improperly adjusted. Proper die adjustment is trial and error, and a few cases may be ruined in the process. If the problem is excess case material from the case stretching after repeated firings, die adjustment is not the answer. Rather, the case should be discarded. The reloader must know how many times a case can be loaded and fired and discard it before such problems occur.

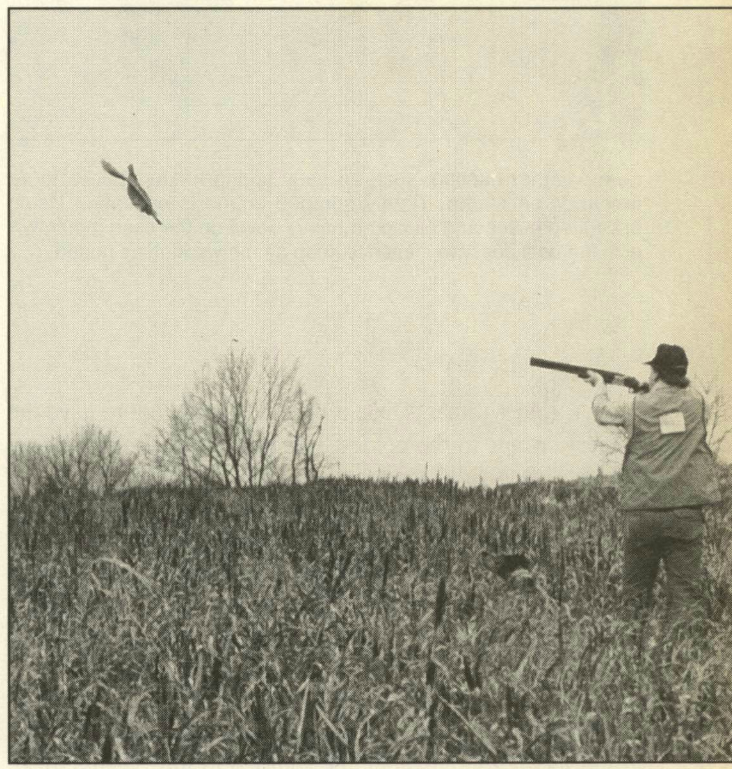
An odd number of folds, or grossly excessive material in the crimp area, may result from the use of a six-point crimp starter on cases that originally had an eight-point crimp. Cases, in part, must be segregated by the number of folds in the original crimp.

The results obtained in the field with reloaded ammunition are a reflection of reloader care and knowledge. It should be remembered that appropriate case crimping is as important to a shotshell as proper bullet seating is to a rifle or handgun round.

Here is a factory load with the center portion of the crimp plastic melted into a circular pattern to make the load waterproof. The melted portion of the crimp is blown away upon firing. Attempting to crimp reloads will result in a hole left in the center of the crimp.



The case on the left has a heavy bevel on its mouth to provide smooth feeding and uniform ballistics compared to the case on the right which has no bevel.



Getting crimps right assures uniform ballistics in the field and on the range.

Hulls with cracks or splits at the crimp fold, or that display a hole in the center of a well-formed crimp, are cases that should have been discarded. Cases should not be fired so many times that splits begin to appear nor used so often that some of the plastic at the very edge of the case is worn away, resulting in insufficient material to completely close the crimp.

Not all factory cases are suitable for reloading. Those with heat-sealed crimps, where the plastic in the center is melted to form a waterproof closure, are not candidates for reloading. When fired, the melted center is torn apart and some of the plastic material is blown away. Attempts to recrimp generally results in a hole in the center of the crimp. Their lack of popularity among reloaders has caused ammunition manufacturers to produce fewer sealed shells, and this style case is now less frequently encountered.

Cases originally roll-crimped, as with shotgun slug loads, are not suitable for most reloading, as it nearly impossible to crimp them in the normal fashion.

Crimps and Ballistics

The crimp keeps the shot pellets in the case during storage, transportation, and in the field. More importantly, it offers sufficient initial resistance until ignition is properly started. Without this, the propellant in many loads would never burn properly, and ballistics would be erratic.

Crimp strength is less important when relatively fast propellants are used in the reload. This is because the pressure level for complete powder burning is reached sooner with the fast powders. Therefore, loads using heavy charges of slow-burning powders, especially magnum loads, require the best possible crimp. Thus, the savvy reloader will save and use his once-fired cases for magnum loads and multi-fired cases only for target or light field loads.

The use of a final crimp die to put a heavy bevel on the case mouth can help firm up a crimp and keep it closed longer at the moment of ignition. A nearby photo shows the appropriate amount of crimp bevel.

It should be remembered that shotshell ballistics are noticeably affected by ambient temperatures. The lower the temperature, the greater the fall-off in average velocity and pressure and the greater shot-to-shot variation for velocity and pressure. Ammo most susceptible to ballistic variation is often

Cold weather hunting, such as early spring turkey, places more demands on ammo. Tightly crimped ammo is essential. Using once-fired cases and placing a heavy bevel on the case mouth will give the best possible crimps to keep ammo working as hoped.

used in cold weather. Thus, it becomes important to have the firmest crimps in the coldest weather. For example, turkey hunting often calls for magnum ammo—heavy charges of slow-burning powder combined with heavy shot charges. Even under moderate temperature conditions, these loads tend to give less than the best ballistic uniformity. If poor crimps become part of the scenario, the reloader might well find his ammo fails to get the job done as expected.

Crimp Starting Die

Forming a good crimp begins with proper adjustment of the crimp starting die. It should be adjusted to form well-defined petals and close the case mouth about 25 to 35 percent.

Ideally, the die will turn freely in order to properly align with the original case folds. The best crimp starting dies are adjustable up and down on the mounting bolt. Simply raise the crimp starter if the case has too much closure; or lower it if insufficient closing and petal-forming occur.

Some crimp starter dies can not be vertically adjusted. With this situation it is sometimes possible to lower the die by placing washers between the top of the die and the tool head. Or it might be more convenient to replace the non-adjustable die with an adjustable one, albeit not all tool makers offer them.

Final Crimp Die

The final crimp die will fully close the crimp. The best dies adjust for overall cartridge length and crimp depth. Properly formed, the crimp should resemble the factory original, though variations will occur depending upon brand and model of loading tool.

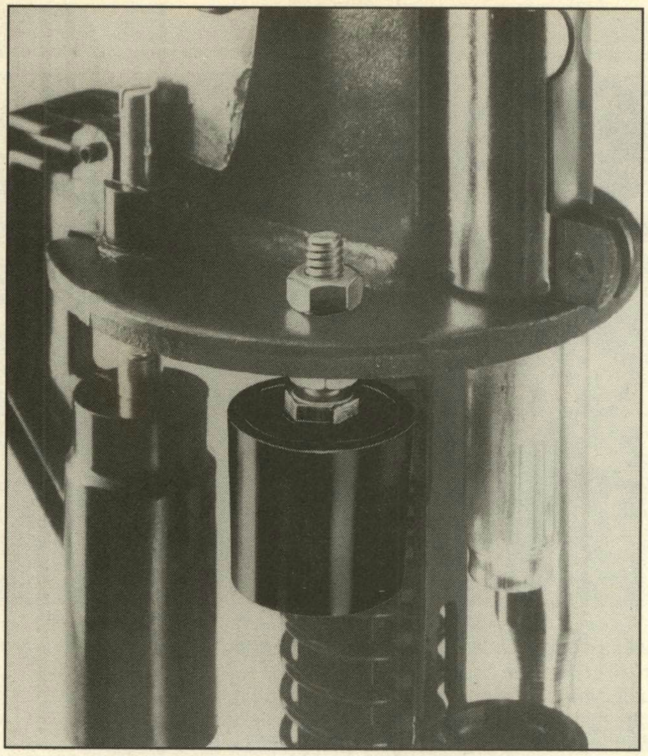
This die station sometimes gives beginning reloaders a bit of grief. However, if the tool manufacturer's instructions are carefully followed, no undue difficulty is generally encountered. Reloading tools not capable of extensive adjustment at the final crimp station may not be suitable for loading all case types, or a wide variety of loads in one specific case style.

Final crimp die adjustments are important, and therefore we will address the most common problems and their remedies.

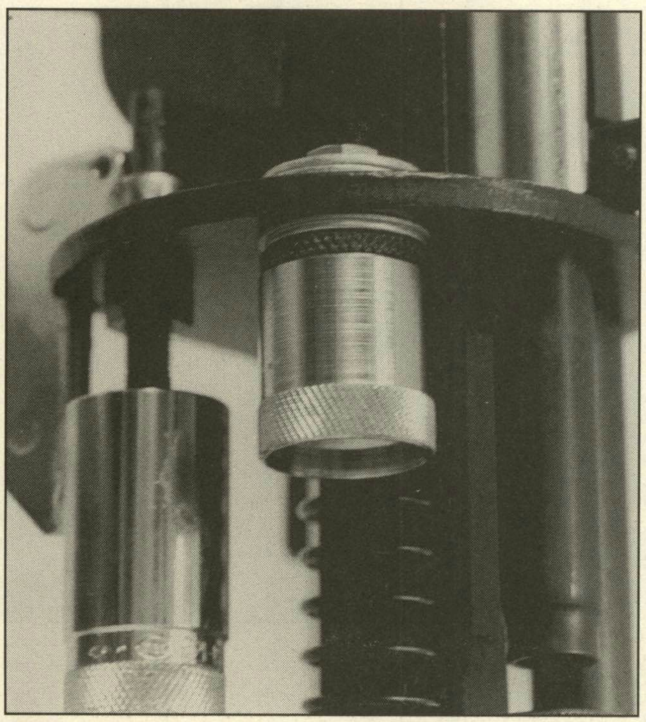
Crimp Too Shallow

When a crimp is too shallow, the petals bulge noticeably above the bevel and the crimp center is partially open. This problem can be corrected by lowering the center of the crimping die, sometimes called the crimp punch. If your die is not

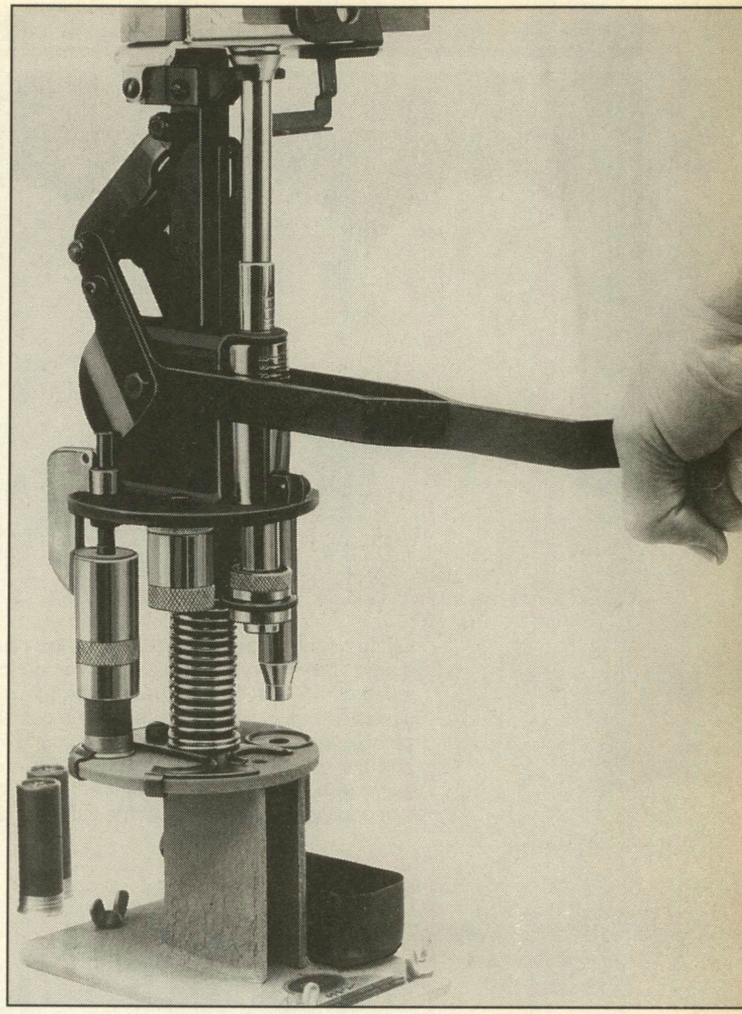
A good crimp begins with a proper crimp start. Shown is a typical eight-point crimp start. The case should display well-formed petals and be 25 to 35 percent closed.



A good crimp start die, such as this Mec Spindex, rotates freely to align precisely with the original crimp. It is also adjustable up and down for the correct amount of preclosing.



If your press is equipped with a non-adjustable crimp starter, placing washers between the die and tool head can effectively lower die position. The two washers above the crimp die have lowered the starter the needed amount. The two washers on top of the die plate are spares.



The final crimp die must be adjusted to give a crimp as close as possible to the original factory load. It should also be capable of putting a good bevel on the loaded case mouth. The die shown has all the necessary adjustments.

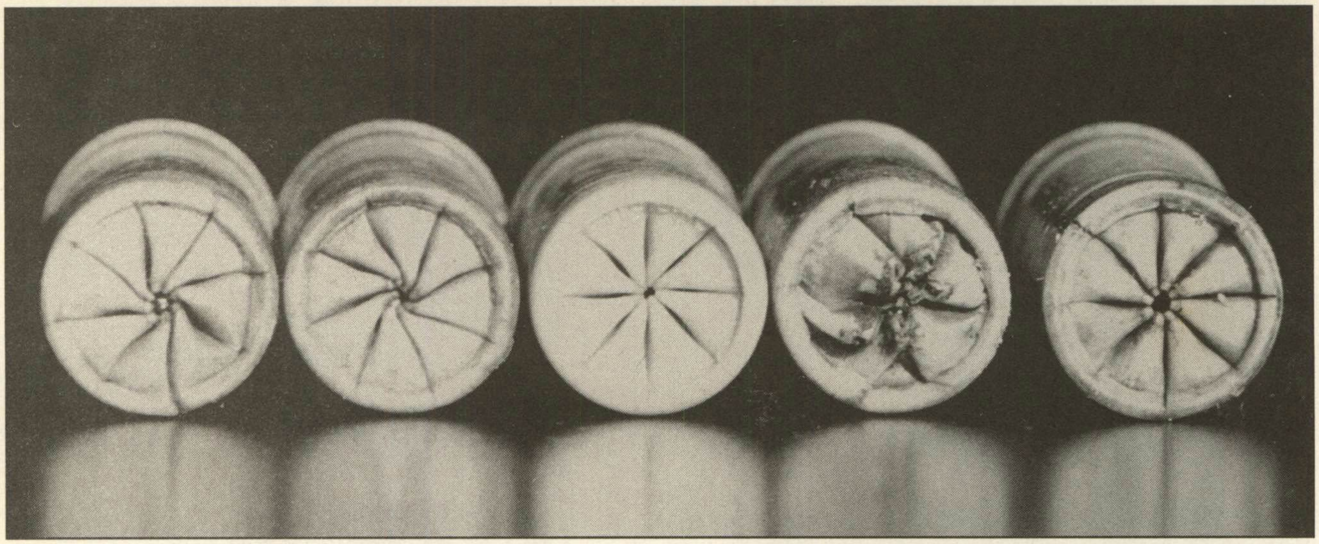
adjustable, lowering the entire die body may correct the problem.

Crimp Too Deep

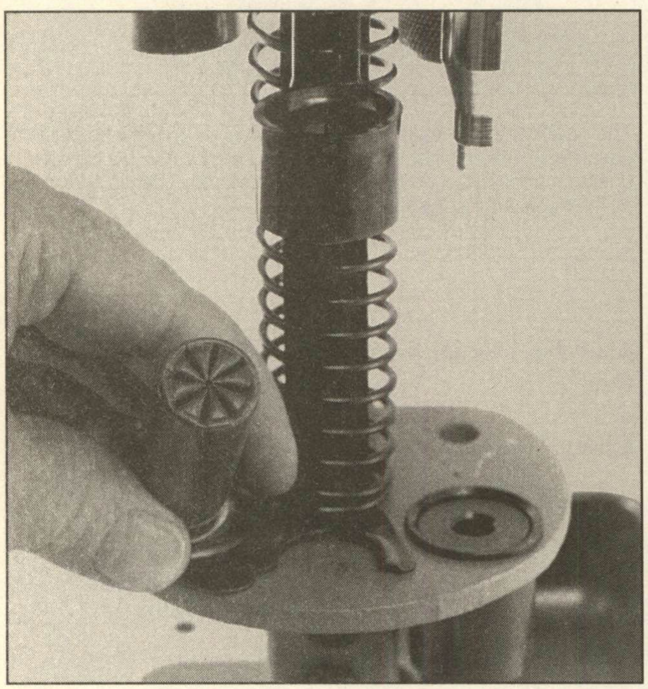
The petals of a crimp seated too deeply angle downward leaving a gap at the crimp center. The amount of case mouth material used to form the folds did not leave enough for the folds to meet in the center, creating an opening from which shot can leak. Raising the crimp punch, or the entire final crimp die body, will correct the problem.

Crimp Open in the Center

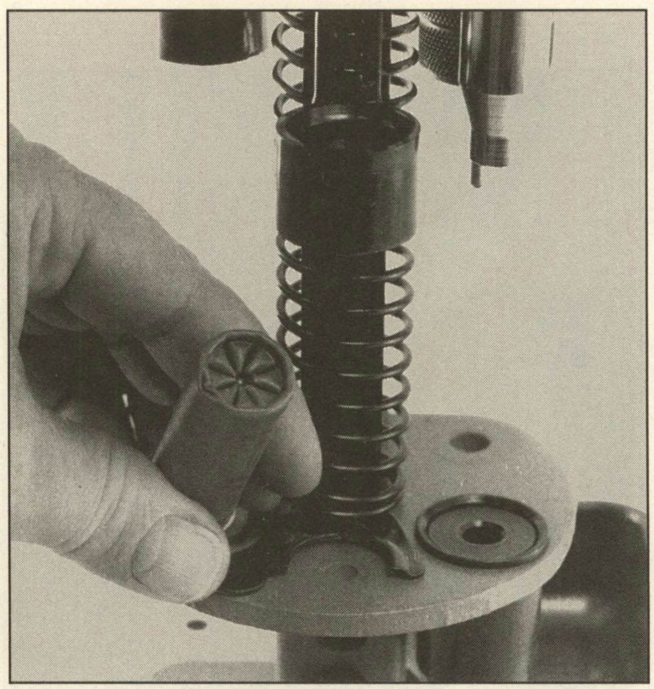
Here, the depth of the crimp is correct, but there still is an opening in the center. A heavier bevel on the case mouth will often close the crimp up. If this doesn't work, the problem may be insufficient case mouth material. Increasing your wad pressure may increase the amount of case mouth material available for crimping.



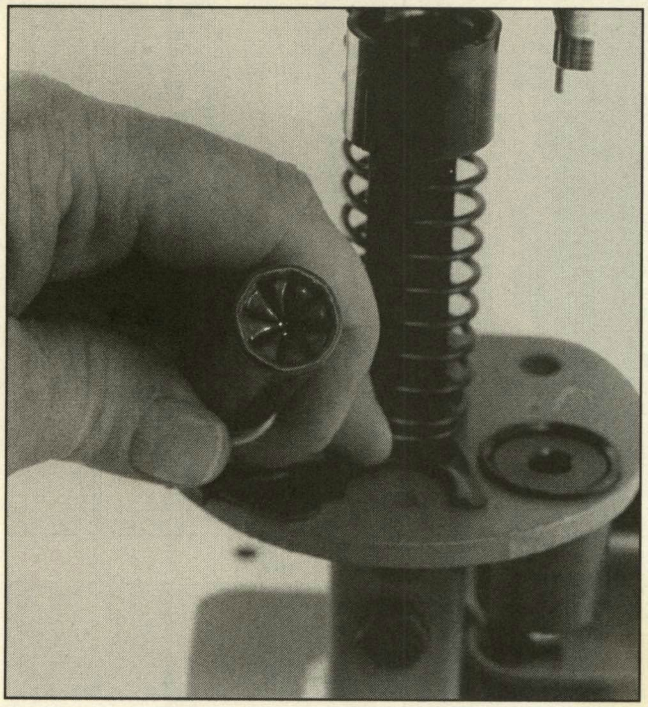
Crimps can tell a great deal about the reloader's sophistication and care in assembling ammo. The crimp also affects ballistic performance. The two shells on the left show a spiralled crimp. The first is due to improper die adjustment; the second is a case which has stretched due to repeated firings. The case in the middle is perfectly crimped and will deliver the expected results. The crimp second from the right is the result of a deteriorated case and the use of a six-point crimp starter on an eight-fold crimped case. The case on the extreme right shows deterioration though the crimp was well formed. Note cracks at the fold and worn away plastic at the center of the crimp.



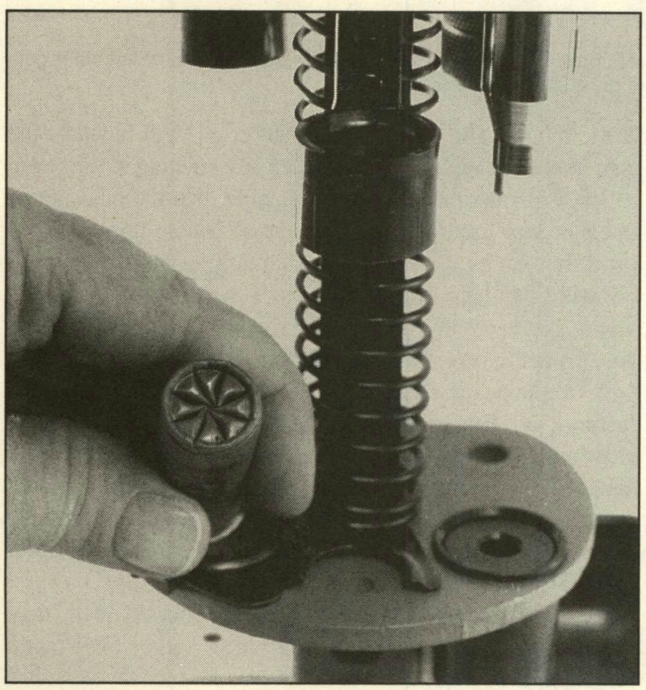
A common mistake is to form a shallow crimp which can later open up.



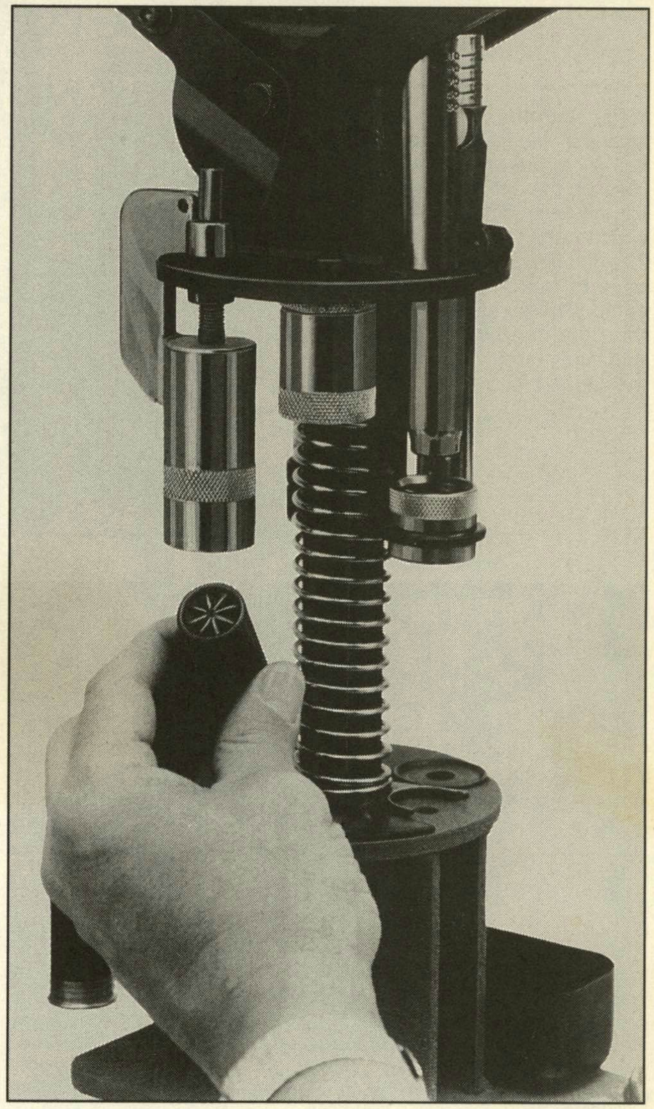
Another improper crimp die adjustment can cause a crimp set too deeply that fails to properly seal the shot in the case.



This crimp is the correct depth, but the crimp has failed to close completely. Placing a heavier bevel on the case mouth will often correct this problem. If this does not work, additional wad pressure may be required to leave sufficient case material to form a complete crimp.

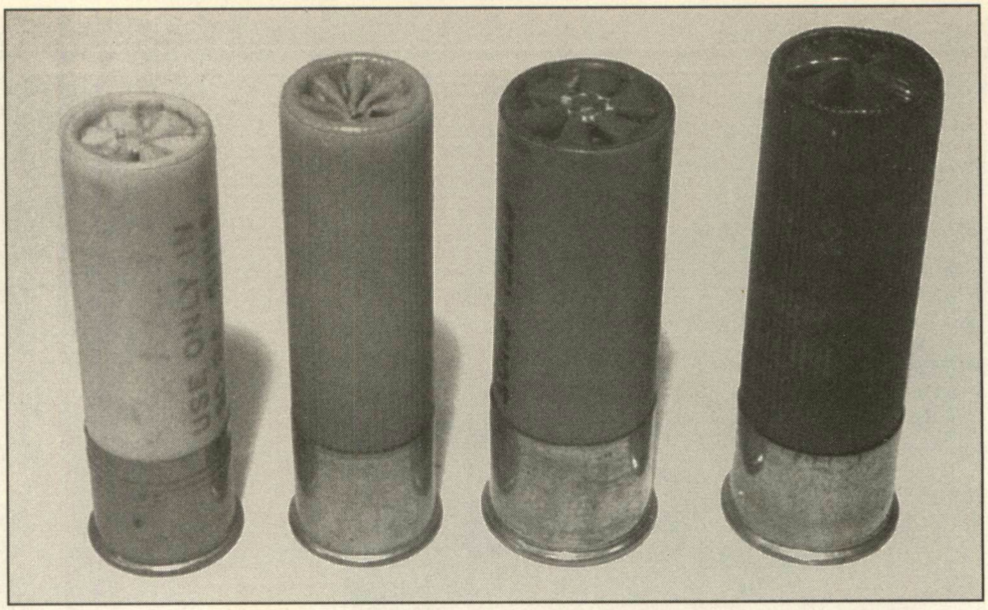


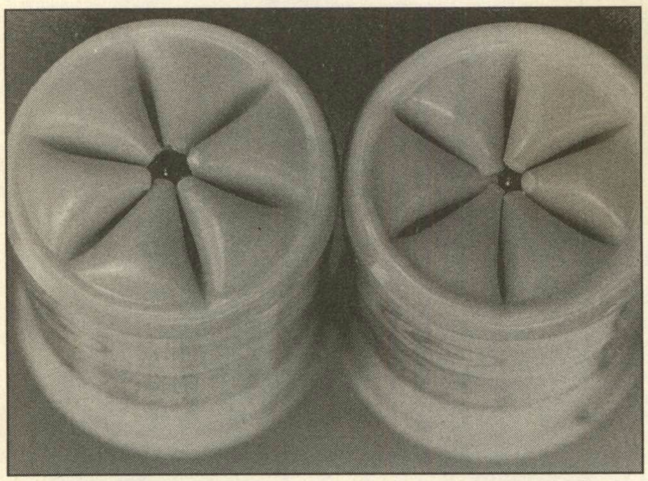
Spiralling is caused by improper tool adjustments or by excess case material in overly stretched cases.



A perfectly formed crimp should be the goal of every shotshell reloader.

When purchasing factory-loaded ammo, select that which has a reproducible crimp. The case on the left and third from the left have factory heat seals which cannot be duplicated. The second from left has an easy to reproduce eight-fold crimp. The six-point crimp on the right can be reproduced with very meticulous die adjustment to do so.





These two reloads were assembled using new, never crimped, cases. The case on the left is loaded with $1\frac{1}{2}$ ounces of #4 shot. While there is an opening in the center of the crimp, it is smaller than the diameter of a single pellet and will thus be satisfactory. The $1\frac{1}{8}$-ounce load of #$7\frac{1}{2}$ shot in the new case on the right required great pains in making the crimping die adjustments to keep the opening smaller than pellet size.

Ammo performance cannot be at its best unless the reloader gets a good crimp on each shell.

Spiraled Twist in Crimp Folds

When a spiral forms, it can be caused by too much case bevel, cases lengthened through repeated use, or too much case mouth material available for crimping.

Reducing the amount of bevel, throwing away the cases, or reducing wad pressure may correct the problem.

Do It Right

A perfectly formed crimp may take as many as a dozen shells to get it as perfect as possible. However, uniform ballistics and a good looking round are well worth the few minutes it takes properly adjust the dies.

As mentioned earlier, a perfect crimp is sometimes difficult or impossible. Crimping new cases never before closed is not easy. It is especially difficult if the cases have not been skived at the mouth. The use of a six-point crimp will facilitate the task. Precisely adjust the die to keep any opening in the crimp as small as possible and always smaller than the diameter of the shot size used. Pumping the press handle up and down (lowering it a bit further with each pump) during final crimping will often help form a good crimp when no other method works. Never try this on a progressive press or any press with auto primer feed, or auto propellant or shot metering.

Crimp appearance may vary slightly from an equivalent factory load. But, some factory crimps cannot be duplicated. Heat-sealed cases or factory shells that have a bit of sealer added in the center of the crimp will often defy a good reloading crimp. It is best to load factory original target-grade ammo. These shells generally have a skived mouth and a reproducible eight-point crimp.

Switching to a different case, or a different load, may require readjustment of the crimp starter and/or final crimp die. Taking a few minutes to do so will produce the very best possible ammo. The rewards will be effective range and/or field performance.

CHAPTER 12

The How And Why Of Patterning

SHOTGUNNERS OFTEN fail to test their ammunition's potential. This is a mistake. A problem assumed to be marksmanship could in reality be ammunition selection or assembly problems. The shooter must remember that shotguns vary in their ability to produce uniform patterns and the multiple hits necessary to break clay targets or to bring fur and feathers to bag. Specific loads may perform admirably in several guns and not at all well in another. It would be rare if, with a bit of testing, a good performing load could not be found for a specific shotgun.

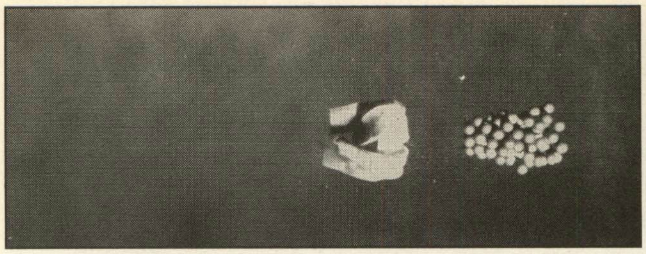
If all the clay birds in a round of Skeet, trap or Sporting Clays are well broken, one can reasonably assume ammo performance is as it should be. And, if most of the game fired at gets into the game bag, it is a safe assumption that shot patterns are sufficiently dense and the point of impact coincides with where the gun points. But, if misses or poorly hit clays and game are experienced, then it is important to determine if the ammunition is at fault.

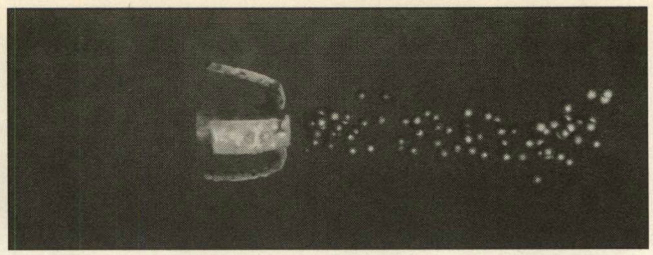
Two major factors govern the dispersion of pellets and the resulting pattern—quality of the shot pellets and degree of choke.

Influence of Shot on Patterns

Shot that deforms during the passage from case to muzzle quickly falls away from the main body of the shot column,

Patterning is the only way the shotgunner can evaluate the performance of a load.





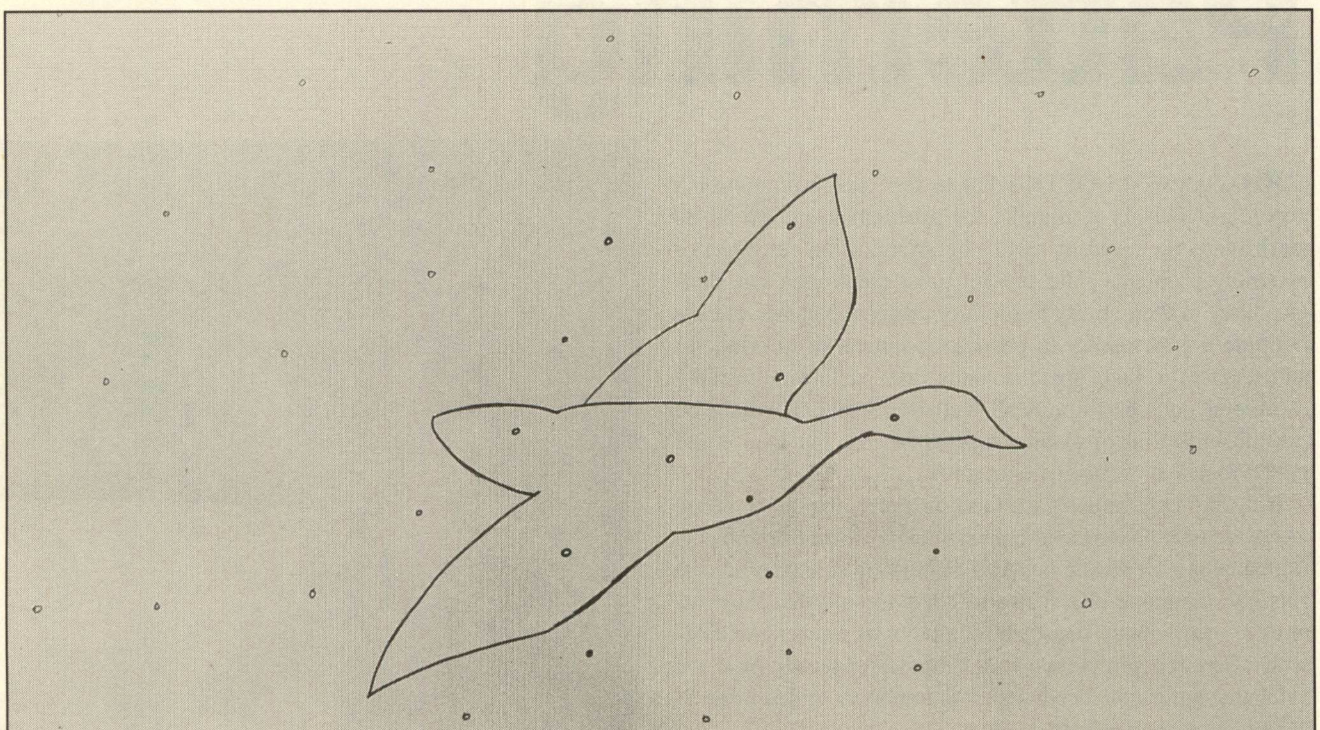
In the photo at left, we see a $1^1/_4$-ounce 12-gauge load inches away from the Improved Cylinder choke it was fired through. The photo on right shows an identical load as fired through a Full choke. The elongation of the Full-choked shot charge is what will keep the pellets in a tight cluster at longer ranges.

producing patterns of less density. It follows, then, that hard shot which better resists deformation will give the denser patterns. Of course, higher velocities cause greater pellet deformation and patterns deteriorate. With chilled (hard) shot, velocities from 1100 to perhaps 1300 fps provide the best possible patterns while maintaining a useful and practical velocity level. Soft shot performance demands a maximum velocity reduction of at least 100 fps to maintain pattern density. Indeed, some experiments suggest a reduction of 200 fps. In turn, the use of extra-hard shot might allow good pattern density with as much as 100 fps *added* to the velocity.

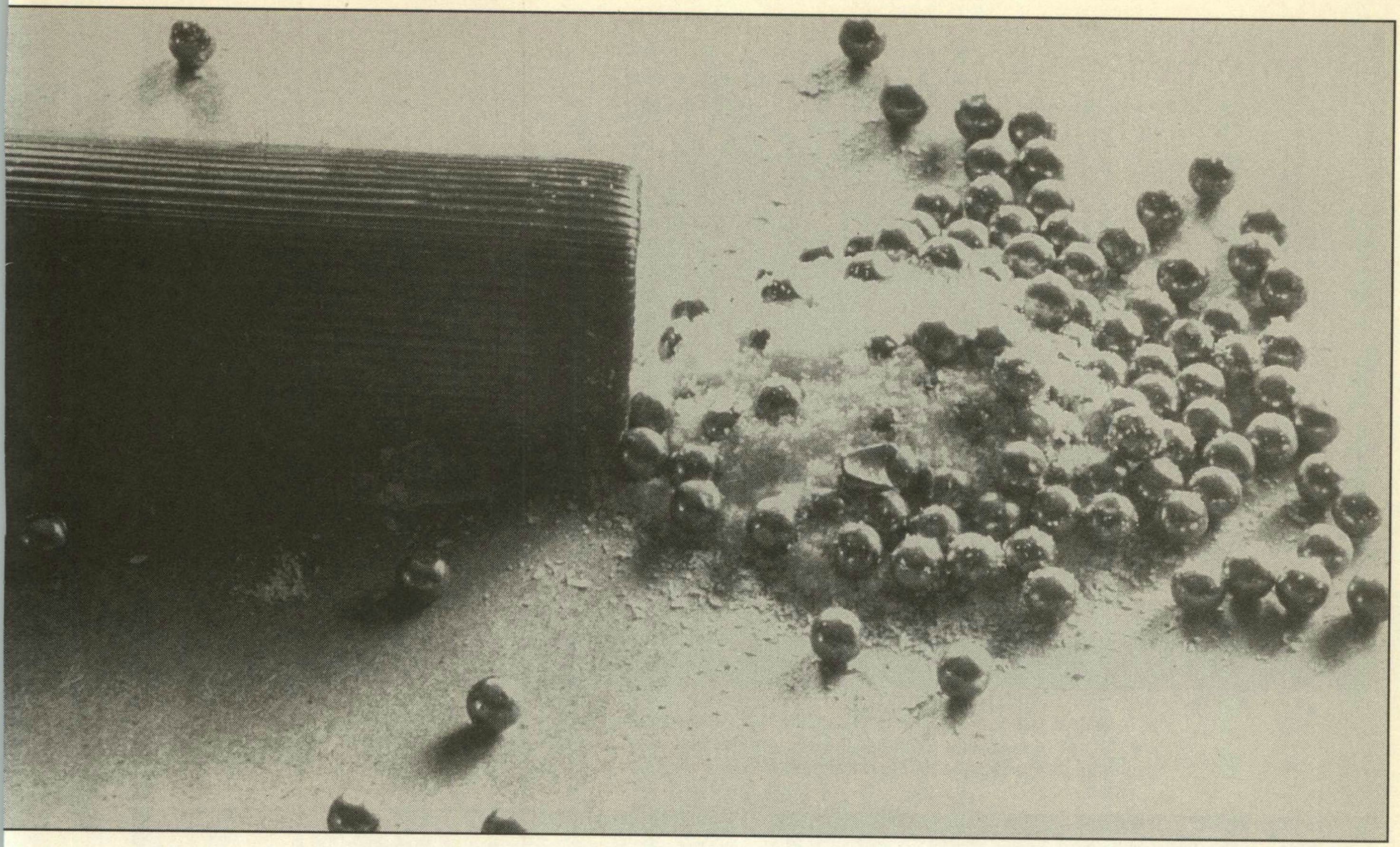
Pellet size is also a contributing factor to pattern density. Generally, the larger sizes suffer the greatest amount of deformation during passage through the forcing cone and choke. As a result, smaller pellet sizes tend to deliver the denser patterns. But, the shooter must pick a pellet size compatible with intended applications. Therefore, buy the hardest shot available in the shot size that matches your intended target.

Matching Shot Size to Quarry or Target Size

The need for a pellet size adequate to penetrate and break vital bones on game is in harmony with the need for sufficient numbers of them in the pattern to bring the game to bag, or to break a clay target. The rule of thumb requires an absolute minimum of five pellet hits to the body to consistently bring game to bag. With this many hits, the likelihood of one being fatal is high. For Skeet, trap or Clays, it takes nearly five pel-



This pattern on a life-size silhouette of the game reveals but three hits to the body (excluding wings, legs and tail) and is thus insufficient for reliable use on the game involved. The shooter would need to use a heavier shot charge and/or a tighter choke to make this pellet size workable. Or the range at which shots are taken could be shortened or, if practical, a smaller shot size could be used.



Some premium-grade factory shotshells incorporate a ground polyethylene material as a buffering agent. This material can help prevent some of the otherwise normal pellet deformation and thus produce tighter patterns.

lets to actually break a clay target, as opposed to simply perforating or chipping it, which may go unnoticed by a scorekeeper. The only way to be certain any load is sufficient for the task is to pattern it on a life-size silhouette of the target or game.

Other Factors

Keep in mind that other ammunition factors will influence pattern percentage. For example, experiments with color-coded shot show that the pellets in the rear of the shot string tend to disperse more. This is because that portion of the shot charge is being subjected to greater deformation during the setback in the early stages of propellant burning. And, as one might expect, the longer shot charges (those of heavier weights) will have a greater number of deformed pellets compared to shorter (lighter) charges. This is the result of the physical forces that occur in the initial stages of shot column acceleration.

Other factors affecting patterns include the burning speed of the propellant, the type of wad used and the ignition characteristics of the primer. Propellants that accelerate the shot column too violently will have a negative effect. Wad legs that collapse too quickly or petals too thin to adequately protect pellets from bore scrubbing will also be negative factors. If you want to know how your ammo performs, you must fire a number of pattern tests.

Gun condition can also affect patterns. Extremely rough bores, out-of-round bores or barrels with dents are just some of the factors that can negatively affect patterns.

Chokes and Patterns

A shotgun choke controls pattern density by narrowing the barrel's inside diameter at the muzzle. There are eight commonly accepted choke constrictions. Table I lists them, from the least to the greatest amount constriction in bore diameter:

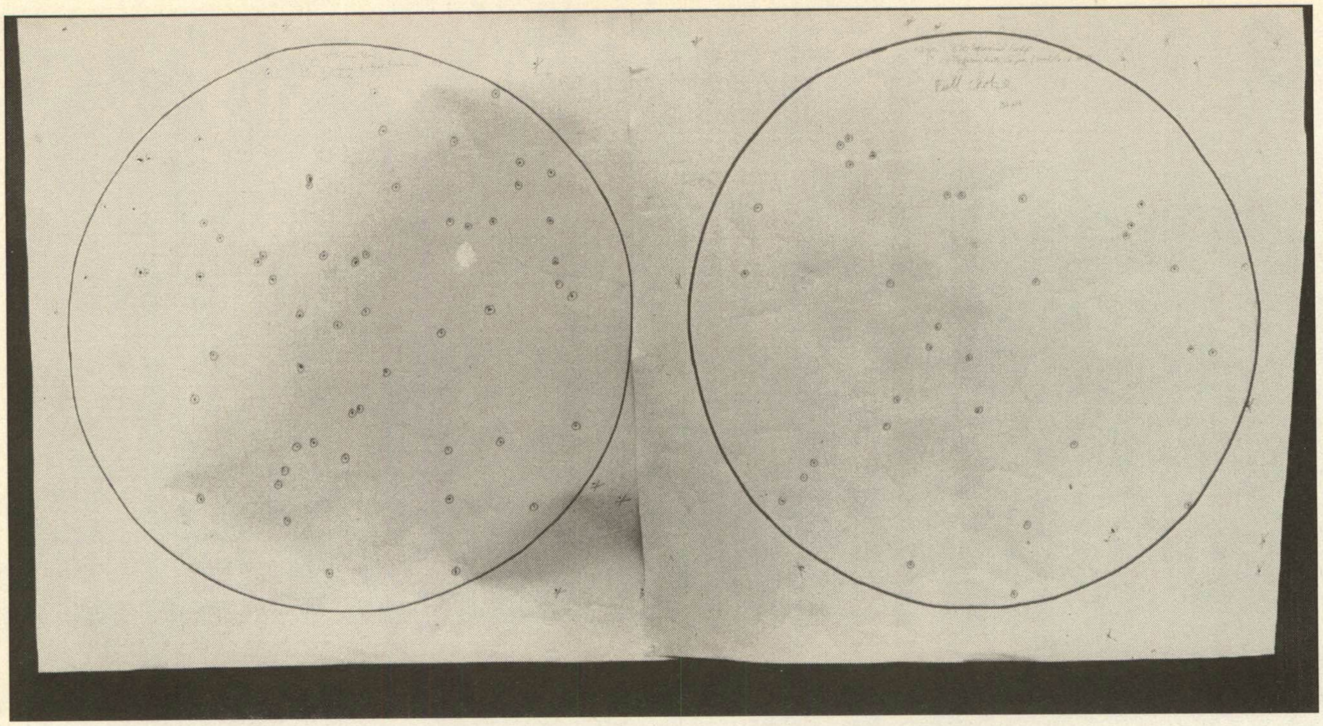
TABLE I

Types of Choke Constriction

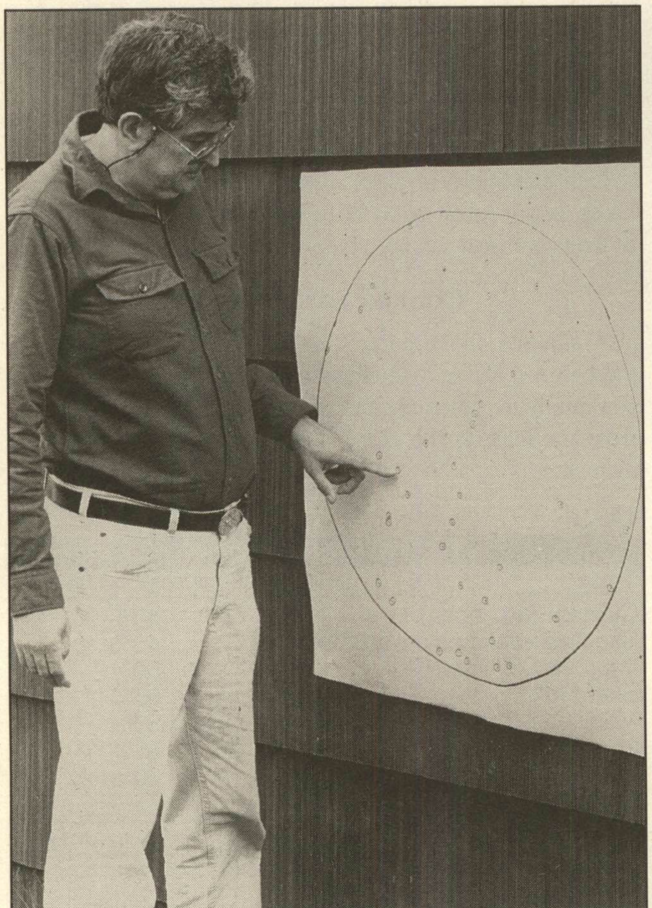
Choke	MinimumPattern Density at 40 yards*
Cylinder (no choke)	40%
Skeet (sometimes called Skeet #1)	45%
Improved Cylinder	50%
Skeet #2	55%
Modified	60%
Improved Modified	65%
Full	70%
Extra Full	75%

*Pattern density is expressed as a percentage of all the pellets in a shell which stay in a 30-inch circle at 40 yards. Skeet chokes and pattern density are often measured at shorter range, with appropriate adjustment for pattern density.

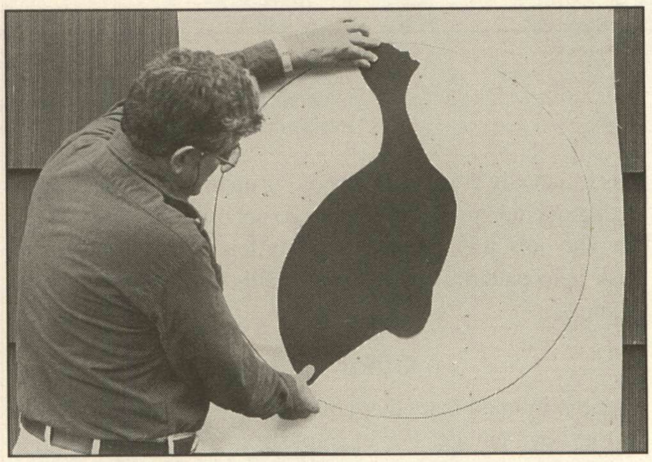
The percentage of the total number of pellets in a shell required to produce a specific degree of choke is somewhat subjective. Regardless of the source, the degree of difference



No two test patterns are likely to contain the same percentage of pellets. Depending on the degree of accuracy required, the shotgunner may want to fire five or ten targets and use the average pellet count to determine effective choking.



Drawing a circle around each pellet hole as it is counted will help the counting go smoothly.



Placing a life-size silhouette over the test patterns can help in evaluating a load and choke combination. An acceptable average pattern will not have pellet-free patches large enough for a silhouette to fit inside with fewer than five shot pellets in the targets' vital area. In the case of the turkey being used here, it would escape multiple head and neck hits.

is minimal, usually no more than 5 percent. Since pellet size influences pattern density, smaller shot almost always delivers noticeable increases in density. Therefore, a barrel and choke that gives Full choke performance with #7$^{1}/_{2}$ shot may deliver only Improved Modified percentages with #4 pellets.

Chokes work by elongating the shot column—the more constriction, the longer the shot column. Nearby high-speed photos show a 12-gauge 1$^{1}/_{4}$-ounce load as fired from an Improved Cylinder choke and a Full choke. The shot column from the Full choke barrel is much longer. A shotgun choke works much as a garden hose nozzle: Open the nozzle to a wide diameter and the spray travels only a limited distance, but the water droplets cover a very wide area; close the nozzle down and the water travels much further, but covers a much narrower area. The same principle is true for chokes. Use a wide diameter and you get short-range effectiveness (wide patterns of sufficient density). Use a narrow diameter and the shot column will stay together longer, dispersing into a useful pattern at greater ranges. No increase in pattern coverage would be gained from making the inside muzzle diameter of a barrel larger than the bore diameter. Contrary to popular belief, the muzzle-loading blunderbuss, the guns used by our forefathers, were shaped that way only to facilitate easy loading.

TABLE II

Traditional Bore And Choke Diameters In Inches

Gauge	Cylinder	Full
4	0.935	
8	0.835	
10	0.775	0.745
12	0.729	0.700
14	0.693	
16	0.670	0.645
20	0.615	0.590
24 (12mm)	0.579	
28	0.550	0.530
32 (14mm)	0.502	
36-bore (9mm)	0.360	
410-bore	0.410	0.390

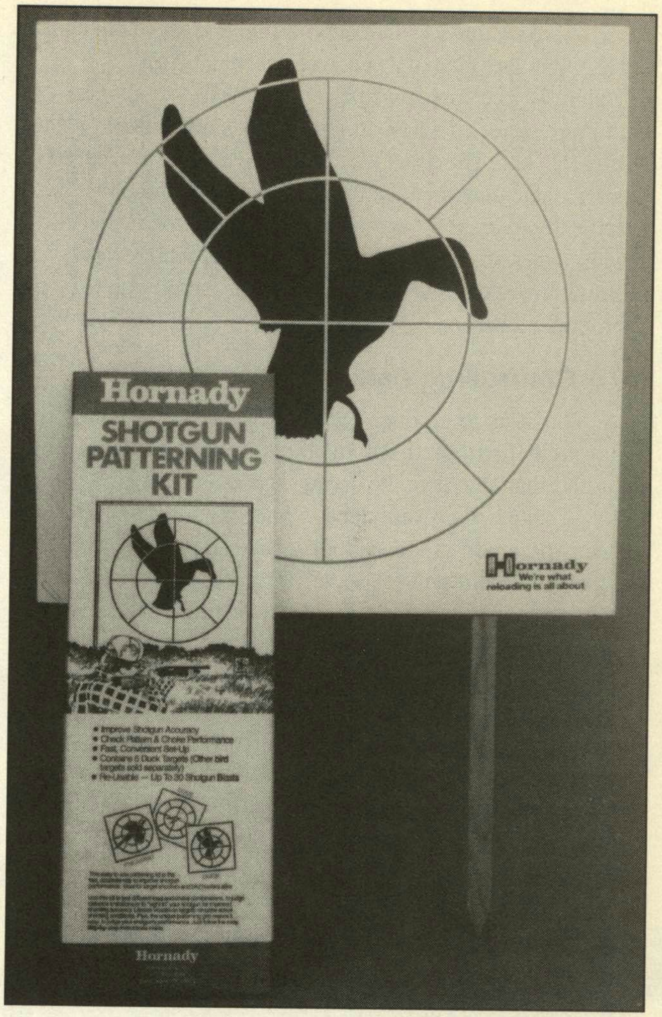
Chokes are sometimes configured much like a "jug." A portion of the barrel widens to larger than bore size and then restricts to a diameter equal to or smaller than bore diameter. Expensive to manufacture, this type of choke has never really proven to be any more effective than the more common styles.

Chokes are not absolutes—a gun marked Full choke will not always deliver a Full choke pattern. As mentioned earlier, the hardness and size of the shot used, as well as the total weight of the shot charge, will affect patterns. Testing shows that larger diameter pellets result in more open patterns. Paradoxically, tests using very large diameter pellets and less choke constriction sometimes result in the smallest diameter patterns. This is evident by the number of shooters who use buckshot-size pellets and find an Improved Cylinder choke to give the tightest patterns. Again, the only way to know what results are being obtained is to pattern the shotgun and load.

It is possible to over-choke and thereby reduce pattern percentages. When the muzzle constriction is too great for the size of shot being used, a very large portion of the shot is deformed and results in patterns that are less dense.

Interchangeable Choke Tubes

Until fairly recently, choke constriction was built into the barrel, and the shooter could do nothing short of an expensive and sometimes iffy gunsmithing job to alter pattern performance. In lieu of such work, the shotgunner often had to assemble and pattern a great many different loads to get the desired performance. Then, adjustable chokes were developed



A preprinted patterning target such as this one from Hornady can make pattern testing less nettlesome.

that mounted on the end of a barrel shortened to remove any built-in choke. Some of these had internal fingers that could be opened or closed by turning a collar at the end of the choke. However, adjustable chokes tended to deform too many pellets — especially those passing over the edges of the fingers.

Other add-on choke devices used interchangeable screw-in tubes of varying diameters. These were more efficient and produced far more uniform patterns, but were a large, ugly and heavy mass on the front end of the barrel. The weight could easily destroy the balance and handling qualities of a shotgun. Eventually, these units lost favor with most shooters, and they have all but disappeared from the market.

Today, we have the best choke method ever devised, tubes which screw directly into the end of the muzzle. They are inexpensive and often available in many more internal diameters than the usual Improved Cylinder, Modified or Full choke dimensions most fixed-choke barrels have. Indeed, one aftermarket tube manufacturer offers at least nine different degrees of choke for 12-gauge guns. Remington offers eight degrees of choke for 12-gauge shotguns.

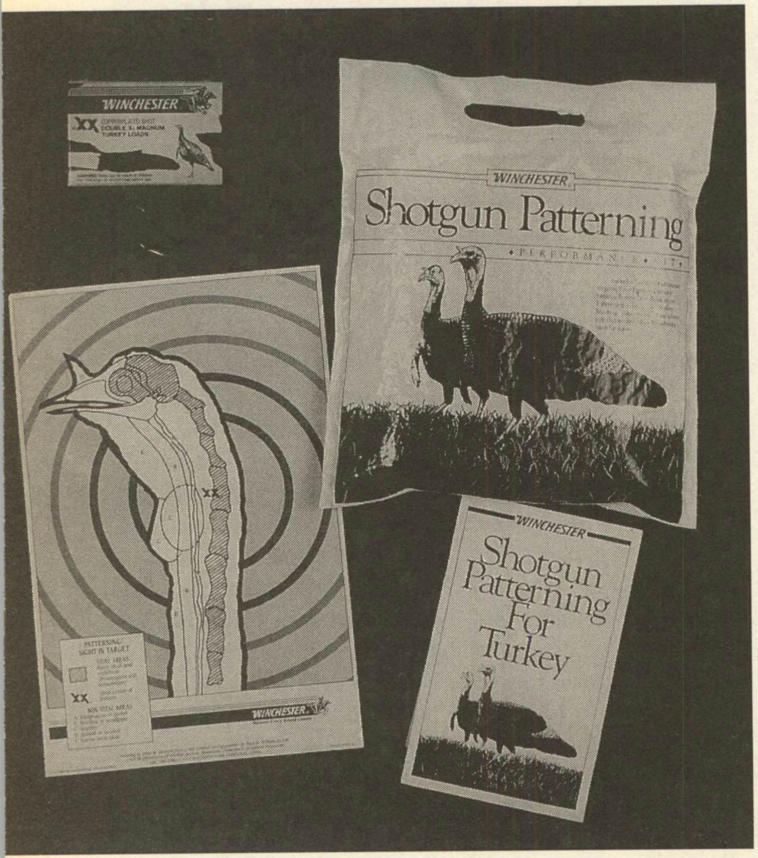
Armed with a handful of choke tubes, the shotgunner can usually adjust choking to maximize performance on the intended ranges and game (or target). Tubes can be purchased for $10 to $12, and the shooter can buy a great many chokes for less than the price of a single replacement barrel.

Naturally, the tubes used must safely fit the shotgun. As with barrels, not all screw-in choke tubes are suitable for use with steel shot. This is especially true with Full or Extra Full tubes. Contact the manufacturer before using a tube that is not specifically marked for use with steel shot. Some makers offer several styles of tubes—those for standard-dimensioned barrels and those for over-bored barrels. Be certain you use only appropriate tubes.

Controlling Patterns With Buffering

Another way to produce tight patterns is to use a buffering agent well distributed among the shot pellets. Depending upon the manufacturer, buffering agents are generally made from a granulated polyethylene of varying dimensions.

Many premium-grade, factory-loaded shotshells use buffering agents to help prevent some of the shot deformation that occurs during shot acceleration. Most likely, these agents work by both cushioning the shot and changing the fluid dynamics of the shot column as it passes through chamber's forcing cone and the choke constriction. The addition of a buffering material greatly changes the pressure time curve of the shot charge. **Caution:** *Internal ballistics would be unsafe if one simply added a buffering agent to a shot charge and compensated only by decreasing the shot charge weight in an amount equal to the weight of the buffering.*



Special pattern targets are available for turkey hunters who want to determine how effective they will be with the required head-only shots.

Most reloaders find diminished pattern percentages when handloading with buffers. The explanation for this would require far more than our available space to discuss. Suffice to say that when the reloader uses buffering agents, it is essential to run comparison tests of buffered and non-buffered loads. Also, a substantial reduction in velocity often occurs when using buffered loads with current data and components because the handloader does not have access to the non-canister grade powders used by the factory. For these reasons, it is usually undesirable to handload buffered loads. When there is a need for such loads, we suggest the use of factory ammo. Therefore, we generally do not list any data for buffered loads in this handbook. There are a few exceptions.

Warning: *Never add a buffering agent to a reload unless you exactly follow the manufacturer's loading recipe. The use of buffering agents with non-buffered data is extremely dangerous and can cause property damage and personal injury, even death. Under no circumstance should any of the data in this handbook be used with buffering agents, except as specifically stated.*

Measuring Patterns

There is a standard testing method to determine choke constriction. For all shotguns, other than the 410-bore, the test pattern is shot at 40 yards. There is often an aiming point in the center of the target. After the shot is fired, a circle of 30 inches in diameter is drawn around the heaviest concentration of shot. The pellet holes are then carefully counted. A circle is drawn around each hole as it is counted to prevent any possible confusion. The 410-bore patterns are tested at 25 yards.

The total number of pellet holes is then divided by the theoretical number of pellets contained in the shot charge. The resulting percentage can then be compared to the choke table percentages listed in this chapter.

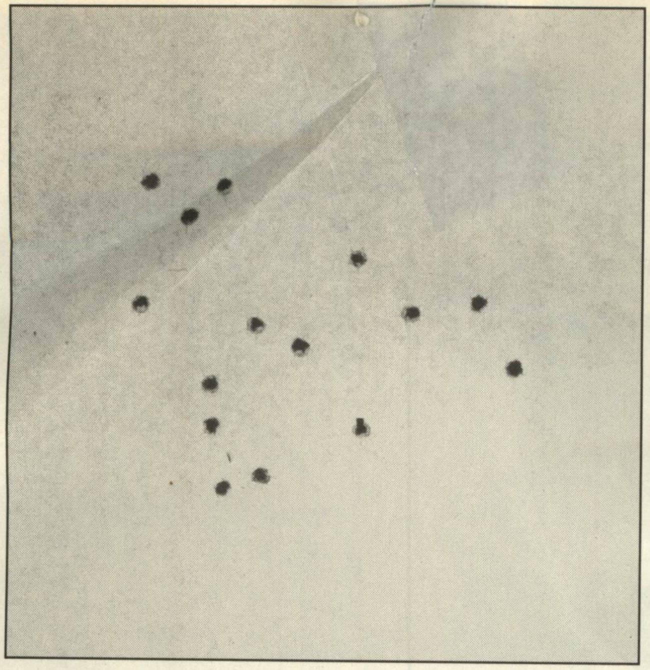
Note that it will take more than one pattern test to determine the average pellet count and effective choking of your gun and load. It is unlikely any two targets will give identical results. If you are not interested in the very last bit of accuracy, a series of five pattern targets will suffice. For more accuracy, use ten. Those requiring the last degree of accuracy had better plan on firing fifteen or more targets.

What's Important Is The Lack Of Large Empty Spaces

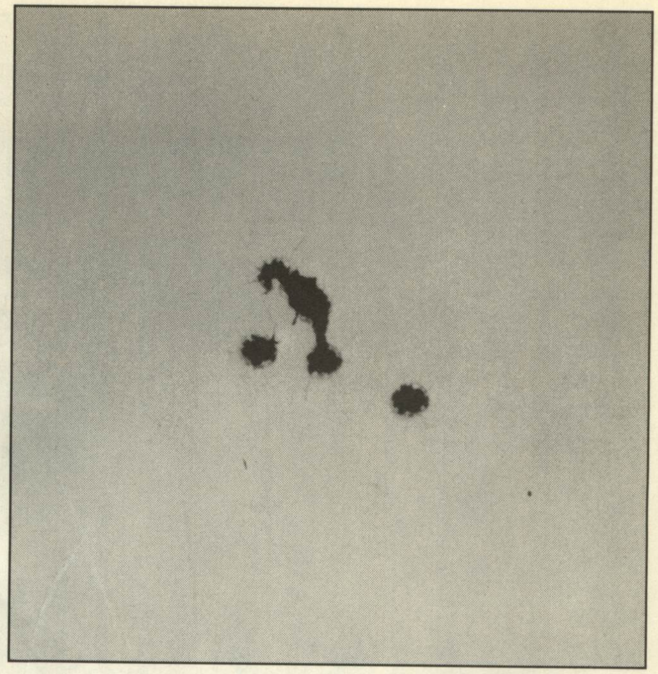
Having a group of patterns that confirms effective choking is simply not conclusive of how well (or poorly) a gun shoots. The shotgunner must visualize what the pattern's effect would be on the intended targets or game. Making a life-size silhouette of the target will prove helpful in interpreting the pattern's effectiveness.

Lay the silhouette on your patterns to see if it will fit in any of the open, unhit areas. If it does, there is an insufficient number of pellets in the load or a choking problem. To remedy the situation, the gunner needs to use one or more of the following: a heavier shot charge, smaller size pellets (if practical), a greater degree of choke, a different load, or shots restricted to shorter ranges.

Smaller targets obviously require more pellets in the pat-



This pattern of 00 buckshot covers less than an 8-inch diameter at 20 yards. The same load at 25 yards would stay under the 15-inch maximum allowable buckshot pattern diameter.



This 16-gauge slug group measures just under 4 inches at 50 yards. Further testing showed that the maximum practical range for the load and gun was 75 yards.

For best possible results, the slug shooter should choose a 12-gauge shotgun with a rifled barrel and top-notch sights. After careful testing of several different slugs, it is frequently possible to get 100-yard groups under 5 inches with such a combination.

Most shotgunners will get the best overall results with an Improved Cylinder choke for upland hunting. In a double gun, use Skeet and Improved Cylinder chokes, as did this shooter, for a wide range of effectiveness.

tern. Attention to pattern density becomes even more important as lighter shot charge weights are used. However, lighter shot charges may be required to control recoil, or because of the limitation of smaller gauge shells. Following the pellet size and minimum shot charge weights suggested in Chapter 10 will help ensure that the shotgunner is using a balanced load for the intended application.

Keep in mind that the patterns obtained in testing are two-dimensional. In the field, patterns will be three-dimensional, and fewer pellets may strike a moving target than that suggested by the two-dimensional pattern target evaluation. The longer the shot column is in flight, the fewer the pellets hitting a moving target. The length of the shot column in flight will be somewhat longer than usual in loads using two or more different shot sizes.

Special Patterning Targets

For convenience, commercial targets are available from Hornady and others that make patterning go a bit quicker. Targets for overall pattern performance as well as specialty evaluation are on the market. One of these, the Winchester target for turkey hunters, is a silhouette of a turkey's head. It will quickly show how many pellets strike at the range used for testing.

Patterning Buckshot Loads

Buckshot loads for big game have different evaluation requirements. Generally speaking, it takes quite a few buckshot pellets to make a killing wound and allow the hunter to readily recover his deer. Practical experience suggests a well-centered pattern on a deer's vitals will work at 25 yards or less. Full evaluation also suggests a buckshot pattern is effective at any range at which the pattern does not exceed 15 inches in diameter. Make a 15-inch diameter disk and place it over pattern targets fired at 20, 25 and 30 yards. At the range which the disk will fully cover the pattern, the load should be effective, but only if the hunter places the load squarely over the vital area. This often requires use of rifle-type sights. At least five patterns should meet the covered-by-the-disk test.

Slug Groups

When testing slugs for accuracy, find the range at which *all* your slugs will stay in a 6-inch group. This becomes the maximum effective range for your load. Bear in mind that most handloaders are unable to duplicate the accuracy of factory slug loads. However, the use of a Cylinder or Improved Cylinder choke often gives the best possible accuracy from a smoothbore. Rifled interchangeable choke tubes frequently better the accuracy potential. The very best accuracy is obtained with fully rifled barrels. It pays to experiment with many different slug types to achieve the maximum possible precision with your shotgun.

Generally, slug groups will be most effective at a range between 50 to 100 yards, for a gun equipped with rifle sights or a scope. The 12-gauge seems to deliver better accuracy than all other gauges.

Slug guns without sights should be used only at very short ranges, not beyond 20 yards. Even then, the shooter should practice to know if the effort will be a sporting one.

Choking And Ranges

The novice might feel, at this point, that the best solution, after balancing shot size and charge weight to the intended quarry, would be to use a Full choke. This would be a correct assumption only at longer ranges, perhaps 35 to 50 yards. But, at shorter ranges, the effective spread of shot would produce a pattern only half as wide as one from an open choke.

This narrow pattern makes it much harder to score a hit. Also, when a hit is made, the dense pellet mass often makes the game unsuitable for table fare, literally tearing it to shreds. At the ranges normally encountered by most gunners, an Improved Cylinder choke will be the most appropriate. Table III gives suggested choke versus range applications for a 12-gauge.

Hunting situations that find you shooting at small targets or over long ranges will require tighter chokes. For example, this head-only shot would be best served with a Full choke.

TABLE III

Choke Versus Range

Choke	Ideal Range (yds.)	Useful Range (yds.)
Cylinder (no choke)	15 to 22	10 to 27
Skeet (also called Skeet #1)	20 to 27	15 to 32
Improved Cylinder	25 to 32	20 to 37
Skeet #2	30 to 37	25 to 42
Modified	35 to 42	30 to 47
Improved Modified	40 to 47	35 to 52
Full	45 to 52	40 to 57
Extra Full	50 to 57	45 to 62

Naturally, no table can compensate for actual field conditions or specific ammunition selection. When using smaller gauge guns with light shot charges, and/or hunting very small game, the effective choke range must be reduced. If using magnum-weight shot charges, the effective range could be somewhat longer. Or if using light, small pellets on larger game, the range will need to be shorter for adequate penetration. As shown in Table III, for most shooters using the right-size pellets and an adequate shot charge weight, the listed ideal range can be stretched by 5 yards for both the minimum and maximum listings for practical field efforts. This gives a range of 17 yards over which a specific choke is practical. Looking at the Improved Cylinder choke, this equates from 20 to 37 yards, which would probably cover 80 percent of most upland hunting situations.

There are exceptions to these general choke suggestions. A squirrel hunter who takes a lot of head-only shots might want a Full choke regardless of the range. Practical experience cannot be replaced by any table or rules of thumb.

Patterns Versus Gauge

The larger the bore diameter, the better the pattern efficiency. This is because fewer pellets come into contact with the wad and bore as the shot column will be shorter for any given charge weight (this includes allowance for the difference in bore surface). Ditto for the ability to handle larger shot sizes. The larger pellets, i.e. #5 through BB, always pattern best from a 12-gauge versus a smaller gauge when all else is equal. This means the shooter who wants the very best patterns, or needs the larger pellet sizes, will always do best with a larger gauge.

Of course, if you never hunt anything bigger than woodcock at modest ranges, a 20-gauge gun will be all you ever need. But as the game gets bigger and/or the ranges longer, and/or the pellet sizes larger and/or the shot charges heavier, the larger 12-gauge gun will prove vastly superior to the smaller 16- or 20-gauge.

Having all the choke and pattern problems squared away, it is important that the shotgun shoots where it points. A perfect pattern that strikes high, low, left or right will be of little value. Point of impact and where the shooter thinks the gun points must be nearly identical. Point of impact can be adjusted by changing the buttstock dimensions or altering shooting habits.

CHAPTER 13

Shotshell Bars And Bushings

SHOTSHELL LOADING is perhaps a bit less refined than metallic cartridge reloading. In the latter, each powder charge is carefully weighed and the projectiles are very uniform in dimension, with weights usually varying by no more than a few tenths of a grain from one to another.

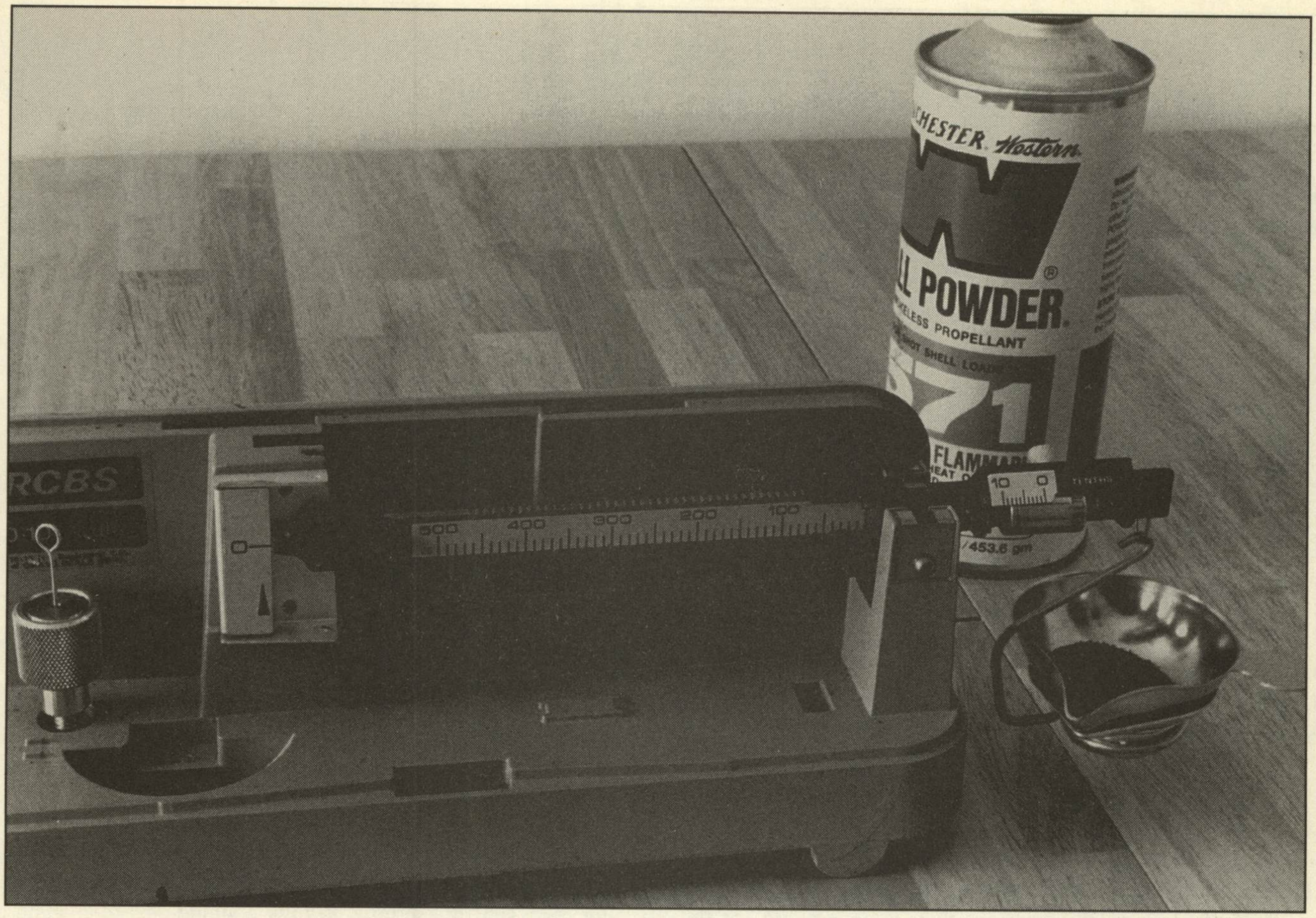
In shotshell assembly, the powder charge is seldom weighed on an individual basis and, indeed, often varies by a tolerance unacceptable to rifle and handgun cartridge reloaders. The same for the shot charge weight. Both powder and shot charges as metered from a shotshell press will not only vary, but will sometimes fail to meet an expected average charge weight. Depending on circumstances, shotshell powder and shot charges can vary enough to produce very poor or even dangerous ammo. However, the savvy reloader can avoid such problems if there is a full understanding of what can happen, and why, to powder and shot charges as they are metered from the press.

The root of the problem lies in the fact that metering is based on the capability of a rather unsophisticated volume-filling process. Powder and shot bushings, or bars, are usually of a fixed dimension, allowing no adjustment for lot-to-lot variation in propellant or shot density. Further, the head (the height and diameter of the shot/powder column contained in the metering reservoir) varies as loading progresses. This can cause a noticeable change in the packing density as shot/powder enters the metering bar or bushing. **Caution:** *The most common reloader error is not realizing that shot and powder bushings do not necessarily throw the charges listed by the manufacturer as being nominal. The metered charges can be dangerously heavy or improperly light.*

Many factors contribute to the variations in propellant and pellet charges thrown. If the reloader uses cases with high-brass heads, the force needed to push the case into the resizing die will be greater. This results in the press operating handle being pulled more forcefully and, in turn, creates more and different press vibrations. This vibration causes the metered components to settle in the bushing or bar in a more dense fashion.

Rifle cartridge reloaders often lightly and repeatedly tap the side of a case as a powder charge is poured in, compacting the charge and creating space for a greater amount of powder. This same condition is repeated in a shotshell tool's metering cavity whenever additional tool vibration is encountered. The vibrations allow the powder granules to settle and pack closer together.

There are other factors that affect press vibration. A heavy-handed operator creates more vibration than one with a light hand. The larger shot sizes demand the metering bar be operated more forcefully. Indeed, the larger shot often jams a metering bar, requiring repeated or forceful blows to execute



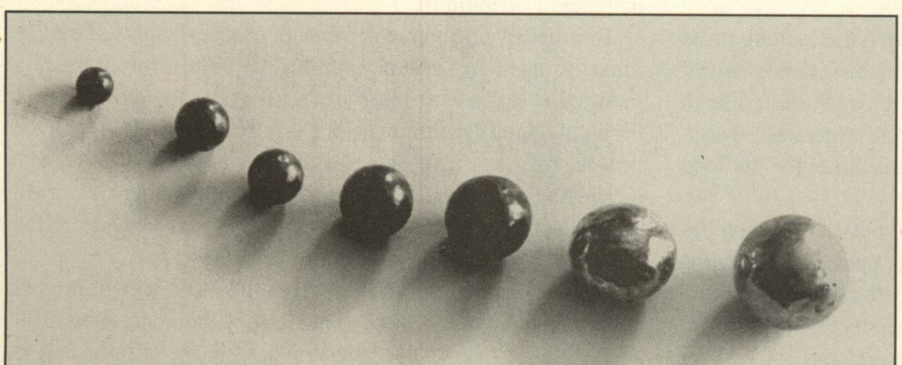
The charges metered by powder and shot bushings and bars can vary greatly from what may be an expected weight. Metered charges must always be verified with a powder and shot scale under exacting conditions.

metering. Or the shot may bridge in the drop tube requiring that the reloader repeatedly tap the tube to free the pellets. And, like high brass hulls, cases fired in a large diameter chamber will require more forceful resizing. Each of these conditions results in substantial changes in metered components, especially in the weight of the powder charge.

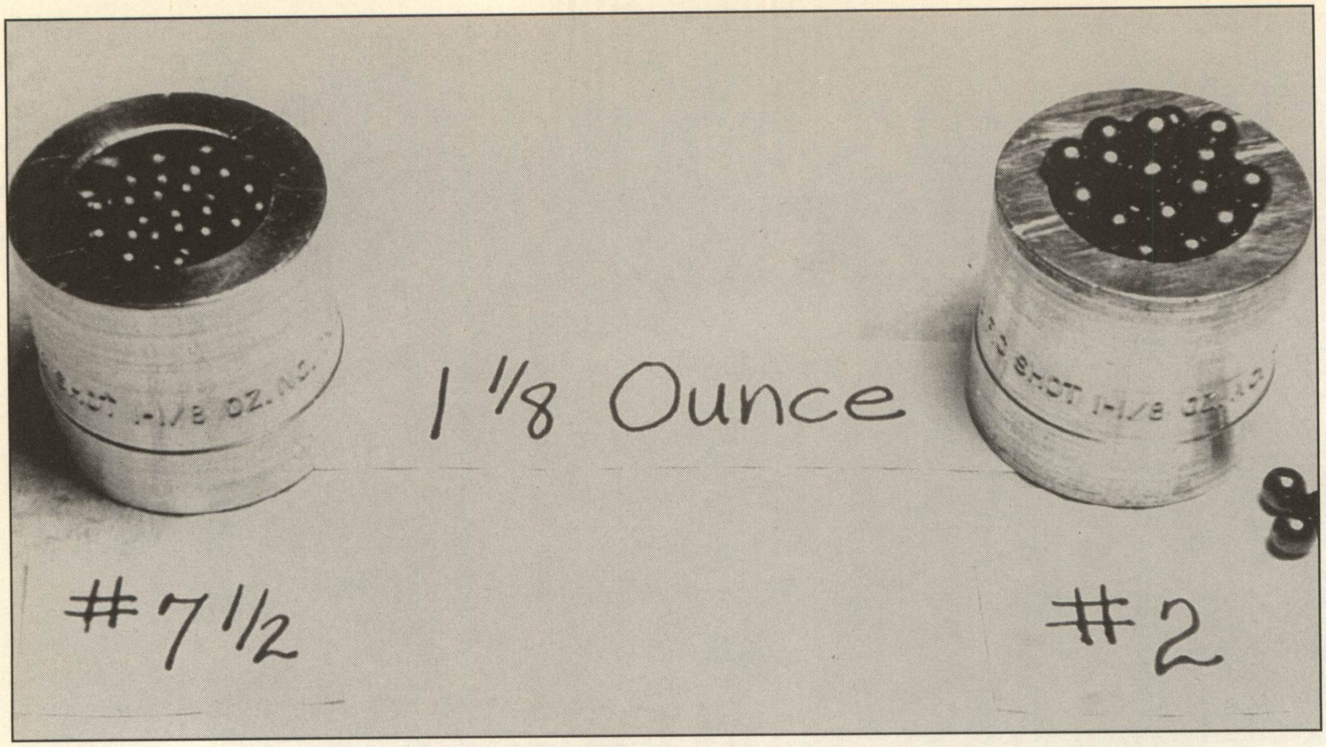
The press itself can contribute to the problem. A loosely mounted press vibrates more than one firmly mounted to the bench. And the tolerances of individual tool assemblies may result in more or less tool vibration.

If all this is not enough, there are the normal manufacturing tolerance variations in the diameter and height of the bushing or bar cavity. To this, add the other pertinent press dimension tolerances that can affect the total weight of the metered charge. About the only thing you can be sure of is that it is highly unlikely metered charges will be exactly as anticipated in published bushing and bar charts.

Some powder systems have difficulty metering powders with narrow webs (a thin cross-section). Fine powders (such as some Ball or spherical types) will seep between the various parts of the metering system. If this occurs, charge uniformity will be poor. Some makers offer a special grommet to place between the top of the powder bushing and the bushing spacer to stop or minimize such seeping.



Shot sizes being loaded will have a direct bearing on the metered charge weight of the pellets. The smallest shot sizes will result in the heaviest charges and the largest sizes in the lightest charges (see text).



Here is an example of how shot sizes affect metered weights. Both shot charges contain exactly 1 1/8 ounces of drop shot, only the shot size differs.

Finally, there is the operator's ability to meter uniform charges. If the metering effort is not uniform, the component drops may vary more in weight than is acceptable for the assembly of reliable and safe ammunition.

It is no wonder that a powder bushing used under one set of circumstances may throw a different charge weight at other times. Equally, a bushing used in one tool may throw an unexpected charge weight when used in another tool. Also, the reloader should keep in mind that variations in charge weights occur when the method of reloading is changed—loading one shell at a time versus several shells in a progressive manner.

Caution: *The manufacturers' bushing/bar charge weight tables are based on certain assumptions that may or may not be present in your loading circumstances. You must weigh a sampling of metered charges, obtained under normal loading conditions, to determine the actual charge weights being metered for a specific loading session.*

Initial Setup

The reloader should use care in mounting the loading press to the bench and adjusting dies and bushings. For initial adjustment of the metered charges, the reloader should have on hand powder bushings two or three sizes larger and smaller than the bushing suggested by the manufacturer for the load being assembled.

Start by double-checking that the listed powder bushing has been placed correctly into the press. It is possible the charge listed in the data source, and the charge listed by the manufacturer on the bushing, do not match exactly. In this event, select the next smaller bushing and drop a charge. A powder charge should never be more than 3 percent under a listed load to avoid substandard ballistics.

For shot, start the setup with only a single charge bushing or bar. These usually throw the correct weight with small shot, and a somewhat lighter weight with larger pellets. However, it is essential the thrown charge be verified and the bar adjusted if need be.

Check-Weighing Thrown Charges

There is only one way to guarantee the powder and shot charges are within specification, and that is to check-weigh them on a good powder and shot scale.

Many shotshell reloaders have erred when attempting to check-weigh powder and shot charges. An accurate assessment cannot be obtained by simply metering ten charges, weighing each, and averaging them. If a press' metering bar is simply operated back and forth ten times, the charges will invariably be lighter than those thrown when the press is used in the actual loading sequence, with the vibrations and slam-banging of operation.

To properly check powder or shot charge weights, the press must be used in sequence under all conditions normally incurred to fully load ten rounds. As each powder charge is dropped, carefully remove the shell from the press, pour the powder from the case onto a scale and record its weight. The same should be done for each metered shot charge. When ten recordings have been made, average them to determine the "nominal" powder and shot charge weight.

Powder charges can average from the listed weight in your data to as little as 3 percent under spec without incurring difficulty. Never use an average powder charge weight that is heavier than recommended—not even just a tiny bit heavier. Shot charges are acceptable with a range from 25 grains light to the nominal weight, but never over weight. For the reader's convenience, Table I converts ounces to grains for the weighing of shot charges.

TABLE I

Ounces To Grains (Avoirdupois) Conversion Table

Ounces	Grains
$2^1/_4$	984.4
$2^1/_8$	929.7
2	875.0
$1^7/_8$	820.3
$1^3/_4$	765.6
$1^5/_8$	710.9
$1^1/_2$	656.3
$1^3/_8$	601.6
$1^1/_4$	546.9
$1^1/_8$	492.2
1	437.5
$^7/_8$	382.8
$^3/_4$	328.1
$^1/_2$	218.8

Powder and shot densities can and do vary by lot. When starting a new can of powder with a different lot number, you must again verify the average charge weight being metered. Since shot bags are not identified by lot numbers, you should verify the average shot charge weight whenever starting a new bag.

Don't be tempted to skip the new lot/bag charge weight verification, even if weights have remained constant over a number of checks. Sooner or later, substantial weight differences will be encountered.

Altering Bushings

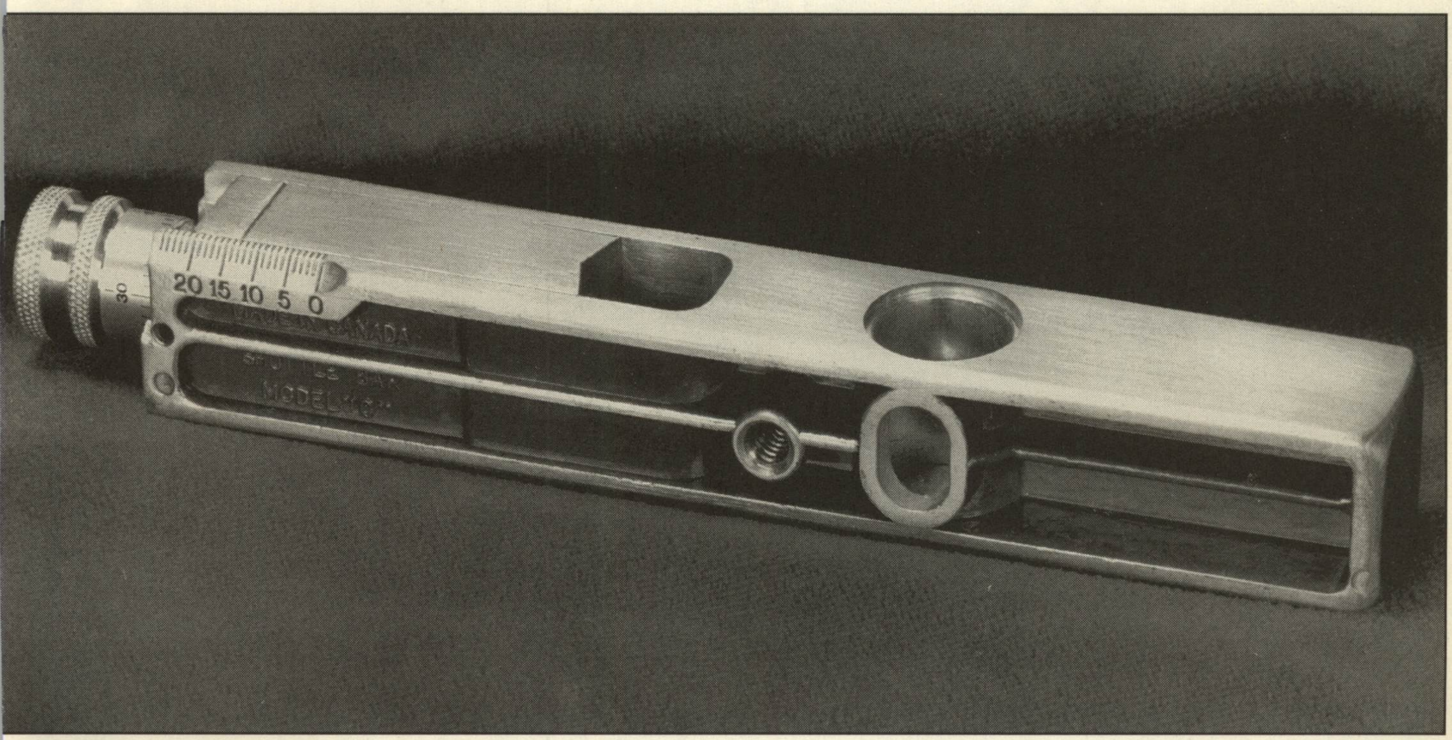
The reloader might wonder why bushings couldn't be custom-altered to meter the exact specified charge weight. This may work for some occasions, but there are pitfalls. Each lot change would require a new custom bushing. As the inventory of modified bushings builds, it would be almost impossible to keep them segregated. Also, a bushing or bar cannot be haphazardly hogged out and expected to supply uniform charges. If the bushing is not kept truly round and its sides truly vertical, metered charges will not pack uniformly and weights will vary, perhaps excessively.

We suggest bushings not be altered. If a powder bushing cannot be found to throw an acceptable charge, it would be wise to select a different load. Shot bushings or bars will usually fall within suggested guidelines. If not, contact the bushing or bar maker.

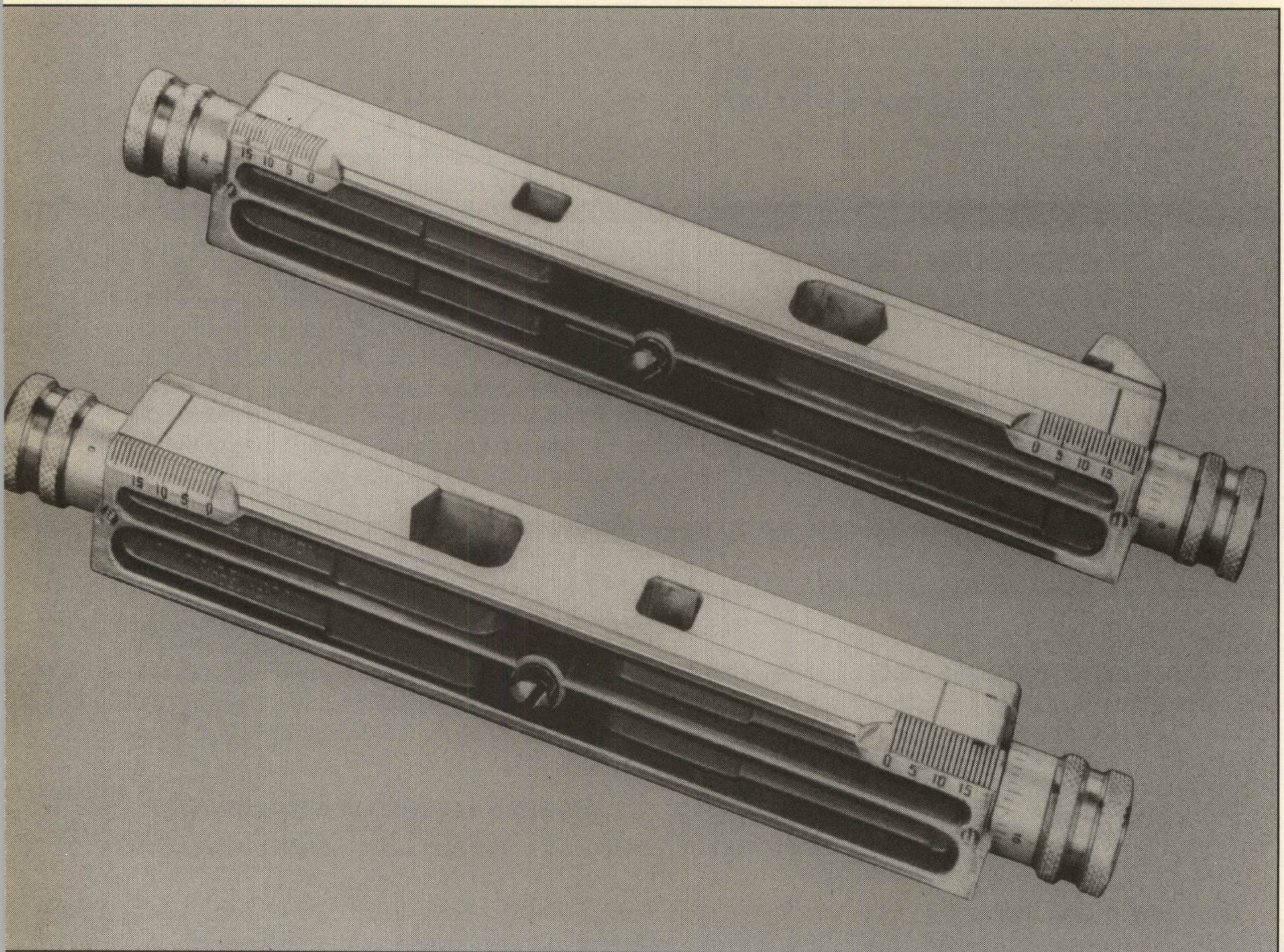
Powder and shot bushings (or shot bars) are unique to specific loading presses, and often to specific models within a brand name. Never attempt to interchange bushings or bars from one brand to another, and always refer to the appropriate model bushing chart when making a selection. Also, don't allow your bushings to become corroded or damaged, as this could negatively affect the precision of the charge metered through them.

Adjustable Powder and Shot Bars

Multi-Scale Charge Ltd. offers adjustable powder and shot



Multi-Scale Charge Bar.



Multi-Scale Shuttle Bar.

bars for certain presses. The cavity size adjusts over a very wide range of charges. However, the resulting cavity shapes give a bit less charge-to-charge uniformity and require frequent check-weighings to ensure the bar has not gone out of adjustment. It is suggested that this check be made at the beginning of every box of ammo (each twenty-five rounds).

Bushing Tables

It is the reloader's responsibility to use the most current powder bushing table for a starting point, and then to verify the charge weight with actual weighings and select bushing size as required. The nearby tables were correct at press time, but they are subject to change from time to time.

HORNADY POWDER CHARGE BUSHINGS
FOR PACIFIC 105, 155, 155 APF AND 155-10

Grains	AL-5	AL-7	AL-8	AL-120	700-X	PB	SR7625	800-X	SR4756	IMR4227	Red Dot	Green Dot	Unique	Herco	Blue Dot	2400	HS5	HS6	HS7	H110	452AA	473AA	540	571	296
10	—	—	—	—	315	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
11	—	—	—	—	330	—	—	—	—	—	—	—	—	—	—	256	—	—	—	—	—	—	—	—	—
12	—	—	—	—	345	327	—	—	—	—	363	357	—	—	—	266	—	—	—	—	—	—	—	—	—
13	—	—	—	—	360	339	—	339	—	—	381	369	—	345	—	—	—	—	—	256	—	—	—	—	250
14	—	—	—	—	375	354	—	351	—	—	390	381	345	357	—	291	—	—	—	266	366	—	—	—	259
15	—	—	—	—	390	369	—	360	351	300	402	393	360	366	—	297	—	—	—	—	375	—	—	—	—
16	—	—	—	—	405	378	360	369	363	312	414	405	369	378	—	303	—	297	—	—	381	342	—	—	—
17	—	—	—	408	417	387	369	378	372	318	429	414	381	390	—	315	—	309	—	291	393	351	—	—	—
18	375	366	—	420	426	399	378	387	384	327	444	429	390	399	—	324	—	315	—	300	396	363	303	—	—
19	381	375	—	432	435	411	387	399	396	336	459	441	402	414	—	333	—	324	—	309	402	372	—	312	—
20	390	381	—	441	450	420	396	411	408	345	471	450	411	426	—	345	—	330	318	318	414	381	—	318	—
21	399	390	408	453	462	432	411	423	417	354	483	459	420	432	—	351	—	336	324	—	423	393	327	327	—
22	408	402	414	465	474	441	420	435	429	360	492	471	432	438	—	357	—	348	330	—	432	399	333	336	—
23	417	411	423	477	486	453	429	447	438	369	510	483	438	453	390	363	—	360	339	—	444	405	342	345	—
24	426	420	432	486	—	462	441	459	447	375	—	495	447	465	399	369	—	366	348	—	453	417	348	351	—
25	438	429	438	495	—	471	447	468	456	384	—	501	456	471	405	378	—	372	354	—	462	426	—	357	—
26	444	438	447	510	—	480	456	474	465	393	—	519	468	480	414	384	366	378	357	—	—	435	363	366	—
27	453	444	459	516	—	489	465	483	474	399	—	525	477	489	420	390	369	384	366	—	—	444	372	375	—
28	462	453	465	522	—	498	474	492	486	405	—	534	483	498	429	396	378	393	375	—	—	453	378	381	—
29	471	459	474	534	—	—	483	501	498	414	—	—	492	510	438	402	384	399	381	—	—	462	384	384	—
30	477	465	486	—	—	510	492	507	501	420	—	—	498	516	444	408	393	405	387	—	—	—	393	393	—
31	486	474	498	549	—	519	498	516	510	426	—	—	—	525	453	417	399	411	393	—	—	—	399	399	—
32	495	480	—	564	—	538	510	525	516	435	—	—	—	534	459	423	408	420	396	—	—	—	405	405	—
33	501	486	510	—	—	549	—	531	525	441	—	—	—	—	465	429	414	426	405	—	—	—	411	411	—
34	—	495	519	573	—	556	—	537	534	447	—	—	—	549	474	435	420	432	411	—	—	—	417	417	—
35	—	501	525	588	—	565	—	543	543	453	—	—	—	558	480	441	—	438	417	—	—	—	423	423	—
36	—	—	534	—	—	—	—	—	549	459	—	—	—	564	486	447	—	444	423	—	—	—	429	429	—
37	—	—	—	—	—	—	—	—	558	465	—	—	—	573	492	453	—	450	429	—	—	—	435	435	—
38	—	—	549	—	—	—	—	—	564	471	—	—	—	—	498	462	—	456	435	—	—	—	441	441	—
39	—	—	558	—	—	—	—	—	573	477	—	—	—	588	507	468	—	462	444	—	—	—	447	447	—
40	—	—	564	—	—	—	—	—	579	483	—	—	—	—	513	474	—	468	447	—	—	—	453	453	—
41	—	—	573	—	—	—	—	—	588	489	—	—	—	—	519	480	—	474	453	—	—	—	459	459	—
42	—	—	—	—	—	—	—	—	594	495	—	—	—	—	525	486	—	480	456	—	—	—	465	465	—
43	—	—	—	—	—	—	—	—	—	498	—	—	—	—	531	492	—	486	459	—	—	—	471	471	—
44	—	—	—	—	—	—	—	—	—	501	—	—	—	—	537	501	—	492	468	—	—	—	477	477	—
45	—	—	—	—	—	—	—	—	—	507	—	—	—	—	549	507	—	—	474	—	—	—	—	483	—
46	—	—	—	—	—	—	—	—	—	513	—	—	—	—	555	513	—	—	480	—	—	—	—	489	—

HORNADY POWDER CHARGE BUSHINGS
FOR PACIFIC 266

Grains	AL-5	AL-7	AL-8	AL-120	700-X	PB	SR 7625	800-X	SR 4756	IMR 4227	Red Dot	Green Dot	Unique	Herco	Blue Dot	2400	HS5	HS6	HS7	H110	452AA	473AA	540	571	296
10	NR	NR	NR	NR	324	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
11	NR	NR	NR	NR	336	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	256	NR	NR	NR	NR	NR	NR	NR	NR	NR
12	NR	NR	NR	NR	351	336	321	NR	NR	NR	375	357	NR	NR	NR	266	NR	NR	NR	NR	NR	NR	NR	NR	NR
13	NR	NR	NR	NR	369	345	333	345	NR	NR	390	372	339	354	NR	—	NR	NR	NR	256	NR	NR	NR	NR	256
14	NR	NR	NR	NR	381	360	342	357	NR	NR	399	384	351	366	NR	291	NR	NR	NR	266	348	327	NR	NR	266
15	NR	NR	NR	NR	393	375	354	369	366	300	417	396	366	375	NR	300	NR	NR	NR	—	360	336	NR	NR	NR
16	NR	NR	NR	NR	405	384	366	384	372	312	435	411	378	387	NR	309	NR	NR	NR	291	372	345	NR	NR	NR
17	NR	NR	NR	414	417	393	378	393	384	318	447	426	390	399	NR	318	NR	309	NR	297	384	357	300	NR	NR
18	378	375	NR	423	429	405	387	405	393	330	459	438	399	408	354	327	NR	318	NR	303	396	366	309	NR	NR
19	387	384	NR	438	441	417	399	414	405	339	468	447	408	420	363	336	NR	327	NR	315	408	378	315	318	NR
20	396	393	NR	450	453	429	411	423	414	348	477	459	417	432	372	NR	NR	336	315	324	420	387	321	327	NR
21	405	402	420	459	462	441	420	432	423	357	486	471	432	441	381	NR	NR	342	327	330	432	396	333	333	NR
22	414	411	429	471	471	453	429	444	432	363	495	480	441	450	390	NR	NR	348	333	NR	441	402	339	339	NR
23	423	420	438	483	483	462	438	453	441	372	513	489	447	459	399	NR	NR	354	342	NR	450	411	348	351	NR
24	432	429	447	492	NR	471	450	465	453	381	NR	498	456	465	408	NR	NR	363	351	NR	459	423	354	357	NR
25	441	441	462	501	NR	480	462	474	462	390	NR	513	465	474	417	NR	NR	372	357	NR	474	432	360	363	NR
26	450	447	474	513	NR	489	471	483	474	396	NR	522	471	483	423	NR	375	381	363	NR	NR	438	369	369	NR
27	459	456	483	522	NR	498	477	495	483	402	NR	531	480	492	432	NR	378	390	372	NR	NR	450	375	378	NR
28	468	465	—	534	NR	—	483	501	492	408	NR	—	489	501	441	NR	384	396	381	NR	NR	456	384	387	NR
29	477	474	492	—	NR	516	492	519	501	417	NR	549	495	513	447	NR	393	402	390	NR	NR	462	390	393	NR
30	483	480	501	549	NR	522	501	525	507	426	NR	NR	501	525	456	NR	402	408	396	NR	NR	NR	396	399	NR
31	489	489	510	558	NR	NR	510	531	513	432	NR	NR	NR	531	462	NR	411	414	405	NR	NR	NR	402	405	NR
32	498	498	519	573	NR	NR	516	543	522	438	NR	NR	NR	—	471	NR	414	423	411	NR	NR	NR	408	411	NR
33	—	—	—	576	NR	NR	NR	549	531	444	NR	NR	NR	549	477	NR	420	429	414	NR	NR	NR	414	417	NR
34	510	513	534	588	NR	NR	NR	558	543	450	NR	NR	NR	558	483	NR	426	435	420	NR	NR	NR	420	423	NR
35	NR	522	549	594	NR	NR	NR	564	549	459	NR	NR	NR	—	489	NR	NR	441	426	NR	NR	NR	429	429	NR
36	NR	NR	—	NR	NR	NR	NR	NR	558	465	NR	NR	NR	564	495	NR	NR	447	432	NR	NR	NR	435	435	NR
37	NR	NR	558	NR	NR	NR	NR	NR	564	471	NR	NR	NR	573	501	NR	NR	453	438	NR	NR	NR	441	441	NR
38	NR	NR	564	NR	NR	NR	NR	NR	573	477	NR	NR	NR	588	510	NR	NR	459	441	NR	NR	NR	447	447	NR
39	NR	NR	576	NR	NR	NR	NR	NR	580	483	NR	NR	NR	—	519	NR	NR	465	444	NR	NR	NR	453	453	NR
40	NR	NR	—	NR	NR	NR	NR	NR	588	492	NR	NR	NR	594	525	NR	NR	NR	450	NR	NR	NR	459	459	NR
41	NR	NR	588	NR	NR	NR	NR	NR	594	498	NR	NR	NR	NR	531	NR	NR	NR	456	NR	NR	NR	465	465	NR

HORNADY POWDER CHARGE BUSHINGS
FOR 366 AUTO

Grains	AA Nitro 100	700-X	PB	SR 7625	800-X	SR 4756	IMR 4227	Red Dot	Green Dot	Unique	Herco	Blue Dot	2400	Hodgdon Clays	HS5	HS6	H110	Royal Scot	Scot 1000	Solo 1250	452AA	473AA	540	571	296	Super Target	Super Lite	Super Field
10	NR	330	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
11	NR	342	324	NR	NR	NR	NR	NR	NR	NR	NR	NR	256	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
12	NR	357	339	324	NR	NR	NR	384	363	NR	NR	NR	266	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
13	NR	369	351	336	351	NR	NR	393	378	342	357	NR	—	NR	NR	NR	256	NR	NR	363	NR	NR	NR	NR	256	NR	NR	NR
14	NR	387	366	345	363	NR	NR	405	390	354	369	NR	291	NR	NR	NR	266	NR	NR	375	360	327	NR	NR	266	NR	NR	NR
15	NR	402	378	357	372	366	303	423	405	369	381	NR	300	NR	NR	NR	—	NR	NR	387	369	339	NR	NR	NR	NR	NR	NR
16	NR	414	390	369	390	378	312	438	420	381	393	NR	312	429	NR	303	291	NR	NR	399	381	348	NR	NR	NR	NR	333	330
17	420	429	402	381	402	387	324	453	435	393	405	NR	324	441	NR	312	300	NR	447	411	390	357	300	NR	NR	405	345	342
18	432	441	414	390	414	399	333	468	447	405	414	366	330	456	NR	318	309	471	456	420	402	369	309	NR	NR	417	354	351
19	444	453	426	402	423	408	339	480	456	414	426	372	339	468	NR	327	315	483	468	432	411	381	318	318	NR	429	363	—
20	456	465	435	414	429	417	348	489	468	423	438	381	NR	483	NR	336	324	495	480	444	420	390	327	330	NR	438	372	—
21	468	477	447	426	438	426	357	498	480	435	450	390	NR	495	NR	345	NR	507	492	456	432	399	336	339	NR	450	381	—
22	NR	486	456	438	447	435	366	510	492	444	462	396	NR	510	NR	354	NR	519	504	468	441	408	345	348	NR	459	390	—
23	NR	498	465	444	459	447	375	519	501	453	471	408	NR	NR	NR	363	NR	531	513	480	450	414	351	357	NR	471	402	—
24	NR	NR	474	453	468	459	384	NR	513	465	477	414	NR	NR	NR	369	NR	543	519	489	462	426	360	363	NR	480	NR	—
25	NR	NR	486	462	480	471	390	NR	522	474	489	423	NR	NR	NR	378	NR	555	531	498	474	435	366	369	NR	NR	NR	411
26	NR	NR	495	474	489	480	399	NR	534	483	498	435	NR	NR	375	387	NR	NR	NR	NR	NR	444	375	378	NR	NR	NR	420
27	NR	NR	—	486	501	489	408	NR	—	492	—	441	NR	NR	381	393	NR	NR	NR	NR	NR	450	381	384	NR	NR	NR	426
28	NR	NR	510	495	507	495	414	NR	549	501	513	447	NR	NR	390	402	NR	NR	NR	NR	NR	462	387	390	NR	NR	NR	432
29	NR	NR	522	—	525	501	420	NR	558	—	522	459	NR	NR	396	408	NR	NR	NR	NR	NR	474	393	396	NR	NR	NR	441
30	NR	NR	NR	501	531	513	426	NR	NR	510	531	468	NR	NR	402	414	NR	NR	NR	NR	NR	NR	402	405	NR	NR	NR	450
31	NR	NR	NR	513	534	522	435	NR	NR	NR	—	474	NR	NR	408	420	NR	NR	NR	NR	NR	NR	408	411	NR	NR	NR	456
32	NR	NR	NR	519	543	525	441	NR	NR	NR	549	483	NR	NR	417	429	NR	NR	NR	NR	NR	NR	414	417	NR	NR	NR	462
33	NR	NR	NR	NR	549	534	447	NR	NR	NR	558	489	NR	NR	423	435	NR	NR	NR	NR	NR	NR	423	423	NR	NR	NR	NR
34	NR	NR	NR	NR	558	543	453	NR	NR	NR	564	495	NR	NR	429	441	NR	NR	NR	NR	NR	NR	429	429	NR	NR	NR	NR
35	NR	NR	NR	NR	564	549	462	NR	NR	NR	573	501	NR	NR	NR	447	NR	NR	NR	NR	NR	NR	435	438	NR	NR	NR	NR
36	NR	NR	NR	NR	NR	558	468	NR	NR	NR	—	510	NR	NR	NR	453	NR	NR	NR	NR	NR	NR	441	444	NR	NR	NR	NR
37	NR	NR	NR	NR	NR	564	474	NR	NR	NR	588	516	NR	NR	NR	459	NR	NR	NR	NR	NR	NR	444	450	NR	NR	NR	NR
38	NR	NR	NR	NR	NR	573	480	NR	NR	NR	594	522	NR	NR	NR	465	NR	NR	NR	NR	NR	NR	450	456	NR	NR	NR	NR
39	NR	NR	NR	NR	NR	580	486	NR	NR	NR	NR	531	NR	NR	NR	471	NR	NR	NR	NR	NR	NR	459	462	NR	NR	NR	NR
40	NR	NR	NR	NR	NR	588	492	NR	NR	NR	NR	534	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	465	468	NR	NR	NR	NR
41	NR	NR	NR	NR	NR	594	498	NR	NR	NR	NR	543	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	471	474	NR	NR	NR	NR
42	NR	NR	NR	NR	NR	—	—	NR	NR	NR	NR	549	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	477	480	NR	NR	NR	NR
43	NR	NR	NR	NR	NR	606	510	NR	NR	NR	NR	555	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	483	486	NR	NR	NR	NR
44	NR	NR	NR	NR	NR	NR	519	NR	NR	NR	NR	561	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	489	492	NR	NR	NR	NR

MEC POWDER CHARGE BUSHINGS

Bushing #	Red Dot/Royal Scot	Green Dot	Herco/S.Tar./B'Eye	2400	Blue Dot/S.lite	800-X	700-X/AA 100	PB/Solo 1250	7625	4756/Unique	4227	Trap 100	H110	296/AA 5	HS7/571	452	473	540/HS6	Solo 1000/Clays	Pearl Scot	AA 2	Win. Sup. Field
10	6.1	6.3	7.9	12.4	10.6	8.8	7.1	7.2	8.2	8.3	11.8	8.0	13.0	13.7	13.4	7.5	9.1	13.0	6.4	6.7	10.7	10.9
11	6.5	6.7	8.3	13.1	11.2	9.3	7.5	7.6	8.7	8.8	12.5	8.5	13.8	14.6	14.2	7.9	9.7	13.8	6.8	7.2	11.3	11.5
12	6.8	7.1	8.8	13.9	11.9	9.8	7.9	8.1	9.2	9.3	13.3	9.0	14.6	15.4	15.0	8.4	10.2	14.6	7.2	7.6	12.0	12.2
12A	7.2	7.5	9.3	14.6	12.5	10.4	8.4	8.5	9.7	9.8	14.0	9.5	15.4	16.3	15.8	8.9	10.8	15.4	7.6	8.0	12.6	12.9
13	7.6	7.9	9.8	15.4	13.2	10.9	8.8	9.0	10.2	10.3	14.8	10.0	16.3	17.2	16.7	9.4	11.4	16.3	8.0	8.4	13.3	13.6
13A	8.0	8.3	10.4	16.3	13.9	11.5	9.3	9.5	10.8	10.9	15.6	10.6	17.1	18.1	17.6	9.9	12.0	17.1	8.5	8.9	14.1	14.3
14	8.4	8.7	10.9	17.1	14.6	12.1	9.8	10.0	11.3	11.4	16.4	11.1	18.0	19.0	18.5	10.4	12.6	18.0	8.9	9.3	14.8	15.0
15	8.9	9.2	11.4	18.0	15.4	12.7	10.3	10.5	11.9	12.0	17.2	11.7	18.9	20.0	19.5	10.9	13.2	19.0	9.3	9.8	15.5	15.8
16	9.3	9.6	12.0	18.9	16.2	13.4	10.8	11.0	12.5	12.6	18.1	12.3	19.9	21.0	20.4	11.4	13.9	19.9	9.8	10.3	16.3	16.6
17	9.7	10.1	12.6	19.8	16.9	14.0	11.3	11.5	13.1	13.2	18.9	12.9	20.8	22.0	21.4	12.0	14.6	20.8	10.3	10.8	17.1	17.4
18	10.2	10.6	13.2	20.7	17.7	14.7	11.9	12.1	13.7	13.8	19.8	13.5	21.8	23.0	22.4	12.6	15.3	21.8	10.8	11.3	17.9	18.2
19	10.7	11.1	13.8	21.6	18.5	15.3	12.4	12.6	14.4	14.5	20.7	14.1	22.8	24.1	23.4	13.1	16.0	22.8	11.3	11.8	18.7	19.0
20	11.2	11.6	14.4	22.6	19.4	16.0	13.0	13.2	15.0	15.1	21.7	14.7	23.8	25.1	24.5	13.7	16.7	23.9	11.8	12.4	19.5	19.9
21	11.6	12.1	15.0	23.6	20.2	16.7	13.5	13.8	15.7	15.8	22.6	15.4	24.9	26.2	25.6	14.3	17.4	24.9	12.3	12.9	20.4	20.8
22	12.1	12.6	15.7	24.6	21.1	17.5	14.1	14.4	16.3	16.5	23.6	16.0	26.0	27.4	26.7	14.9	18.2	26.0	12.8	13.5	21.3	21.6
23	12.7	13.1	16.3	25.7	22.0	18.2	14.7	15.0	17.0	17.2	24.6	16.7	27.0	28.5	27.8	15.6	18.9	27.1	13.3	14.0	22.2	22.6
24	13.2	13.7	17.0	26.7	22.9	18.9	15.3	15.6	17.7	17.9	25.6	17.4	28.2	29.7	28.9	16.2	19.7	28.2	13.9	14.6	23.1	23.5
25	13.7	14.2	17.7	27.8	23.8	19.7	15.9	16.2	18.4	18.6	26.6	18.1	29.3	30.9	30.1	16.9	20.5	29.3	14.5	15.2	24.0	24.4
26	14.3	14.8	18.4	28.9	24.8	20.5	16.6	16.9	19.2	19.3	27.7	18.8	30.5	32.1	31.3	17.5	21.3	30.5	15.0	15.8	25.0	25.4
27	14.8	15.4	19.1	30.0	25.7	21.3	17.2	17.5	19.9	20.1	28.8	19.5	31.6	33.4	32.5	18.2	22.1	31.7	15.6	16.4	25.9	26.4
28	15.4	15.9	19.8	31.2	26.7	22.1	17.9	18.2	20.7	20.9	29.9	20.3	32.8	34.6	33.8	18.9	23.0	32.9	16.2	17.0	26.9	27.4
29	16.0	16.5	20.6	32.3	27.7	22.9	18.5	18.9	21.4	21.6	31.0	21.0	34.1	35.9	35.0	19.6	23.8	34.1	16.8	17.7	27.9	28.4
30	16.5	17.1	21.3	33.5	28.7	23.8	19.2	19.6	22.2	22.4	32.1	21.8	35.3	37.3	36.3	20.3	24.7	35.4	17.4	18.3	29.0	29.5
31	17.1	17.8	22.1	34.7	29.7	24.6	19.9	20.3	23.0	23.2	33.3	22.6	36.6	38.6	37.6	21.1	25.6	36.6	18.1	19.0	30.0	30.5
32	17.7	18.4	22.9	36.0	30.8	25.5	20.6	21.0	23.9	24.1	34.5	23.4	37.9	40.0	38.9	21.8	26.5	37.9	18.7	19.6	31.1	31.6
33	18.4	19.0	23.7	37.2	31.9	26.4	21.3	21.7	24.7	24.9	35.7	24.2	39.2	41.4	40.3	22.6	27.4	39.2	19.3	20.3	32.2	32.7
34	19.0	19.7	24.5	38.5	33.0	27.3	22.0	22.5	25.5	25.7	36.9	25.0	40.6	42.8	41.7	23.3	28.4	40.6	20.0	21.0	33.3	33.8
35	19.6	20.3	25.3	39.8	34.1	28.2	22.8	23.2	26.4	26.6	38.1	25.9	41.9	44.2	43.1	24.1	29.3	42.0	20.7	21.7	34.4	35.0
36	20.3	21.1	26.2	41.1	35.2	29.1	23.5	24.0	27.3	27.5	39.4	26.7	43.3	45.7	44.5	24.9	30.3	43.3	21.4	22.4	35.5	36.1
37	20.9	21.7	27.0	42.4	36.3	30.1	24.3	24.8	28.1	28.4	40.7	27.6	44.7	47.1	45.9	25.7	31.3	44.7	22.1	23.2	36.7	37.3
38	21.6	22.4	27.9	43.8	37.5	31.0	25.1	25.6	29.0	29.3	42.0	28.5	46.1	48.7	47.4	26.6	32.3	46.2	22.8	23.9	37.8	38.5
38A	22.3	23.1	28.8	45.2	38.7	32.0	25.9	26.4	30.0	30.2	43.3	29.4	47.6	50.2	48.9	27.4	33.3	47.6	23.5	24.7	39.0	39.7
39	23.0	23.8	29.7	46.6	39.9	33.0	26.7	27.2	30.9	31.2	44.6	30.3	49.1	51.7	50.4	28.3	34.3	49.1	24.2	25.4	40.2	40.9
39A	23.7	24.5	30.6	48.0	41.1	34.0	27.5	28.0	31.8	32.1	46.0	31.2	50.6	53.3	52.0	29.1	35.4	50.6	24.9	26.2	41.5	42.2
40	24.4	25.3	31.5	49.4	42.3	35.0	28.3	28.9	32.8	33.1	47.4	32.1	52.1	54.9	53.5	30.0	36.4	52.1	25.7	27.0	42.7	43.4
40A	25.1	26.0	32.4	50.9	43.6	36.1	29.1	29.7	33.8	34.1	48.8	33.1	53.6	56.6	55.1	30.9	37.5	53.7	26.5	27.8	44.0	44.7
41	25.8	26.8	33.4	52.4	44.9	37.1	30.0	30.6	34.7	35.0	50.2	34.1	55.2	58.2	56.7	31.8	38.6	55.2	27.2	28.6	45.3	46.0
41A	26.6	27.5	34.3	53.9	46.2	38.2	30.9	31.5	35.7	36.1	51.6	35.0	56.8	59.9	58.4	32.7	39.7	56.8	28.0	29.4	46.6	47.4
42	27.3	28.3	35.3	55.4	47.5	39.3	31.7	32.4	36.8	37.1	53.1	36.0	58.4	61.6	60.0	33.6	40.9	58.4	28.8	30.3	47.9	48.7
42A	28.1	29.1	36.3	57.0	48.8	40.4	32.6	33.3	37.8	38.1	54.6	37.0	60.0	63.3	61.7	34.6	42.0	60.1	29.6	31.1	49.2	50.1
43	28.9	29.9	37.3	58.5	50.1	41.5	33.5	34.2	38.8	39.2	56.1	38.1	61.7	65.0	63.4	35.5	43.2	61.7	30.4	32.0	50.6	51.5

LEE POWDER CHARGE BUSHINGS

Powder	.095	.100	.105	.110	.116	.122	.128	.134	.141	.148	.151	.155	.163	.171	.180	.189	.198
Red Dot	11.0	11.6	12.2	12.8	13.5	14.2	14.8	15.5	16.4	17.2	17.5	18.0	18.9	19.8	20.9	21.9	23.0
Green Dot	12.3	13.0	13.6	14.3	15.1	15.8	16.6	17.4	18.3	19.2	19.6	20.1	21.2	22.2	23.4	24.5	25.7
Blue Dot	18.0	19.0	19.9	20.8	22.0	23.1	24.3	25.4	26.7	28.0	28.6	29.4	30.9	32.4	34.1	35.8	37.5
Unique	14.3	15.0	15.8	16.5	17.4	18.3	19.2	20.1	21.2	22.2	22.7	23.3	24.5	25.7	27.0	28.4	29.7
Herco	13.9	14.6	15.3	16.1	16.9	17.8	18.7	19.6	20.6	21.6	22.0	22.6	23.8	25.0	26.3	27.6	28.9
2400	21.0	22.1	23.2	24.3	25.6	27.0	28.3	29.6	31.2	32.7	33.4	34.3	36.0	37.8	39.8	41.8	43.8
Clays	10.6	11.2	11.8	12.3	13.0	13.7	14.3	15.0	15.8	16.6	16.9	17.4	18.3	19.2	20.2	21.2	22.2
HS6	21.9	23.0	24.2	25.3	26.7	28.1	29.4	30.8	32.4	34.0	34.7	35.7	37.5	39.3	41.4	43.5	45.5
HS7	22.9	24.1	25.3	26.5	28.0	29.4	30.8	32.3	34.0	35.7	36.4	37.4	39.3	41.2	43.4	45.6	47.7
H110	23.2	24.4	25.6	26.8	28.3	29.8	31.2	32.7	34.4	36.1	36.8	37.8	39.8	41.7	43.9	46.1	48.3
H4227	20.2	21.3	22.4	23.4	24.7	26.0	27.3	28.5	30.0	31.5	32.2	33.0	34.7	36.4	38.3	40.3	42.2
700X	11.6	12.2	12.8	13.4	14.2	14.9	15.6	16.3	17.2	18.1	18.4	18.9	19.9	20.9	22.0	23.1	24.2
800X	14.5	15.3	16.1	16.8	17.7	18.7	19.6	20.5	21.6	22.6	23.1	23.7	24.9	26.2	27.5	28.9	30.3
PB	12.9	13.6	14.3	15.0	15.8	16.6	17.4	18.2	19.2	20.1	20.5	21.1	22.2	23.3	24.5	25.7	26.9
SR4756	14.2	14.9	15.6	16.4	17.3	18.2	19.1	20.0	21.0	22.1	22.5	23.1	24.3	25.5	26.8	28.2	29.5
SR4759	15.7	16.5	17.3	18.2	19.1	20.1	21.1	22.1	23.3	24.4	24.9	25.6	26.9	28.2	29.7	31.2	32.7
IMR4227	20.2	21.3	22.4	23.4	24.7	26.0	27.3	28.5	30.0	31.5	32.2	33.0	34.7	36.4	38.3	40.3	42.2
452AA	13.3	14.0	14.7	15.4	16.2	17.1	17.9	18.8	19.7	20.7	21.1	21.7	22.8	23.9	25.2	26.5	27.7
473AA	16.0	16.8	17.6	18.5	19.5	20.5	21.5	22.5	23.7	24.9	25.4	26.0	27.4	28.7	30.2	31.8	33.3
540	22.8	24.0	25.2	26.4	27.8	29.3	30.7	32.2	33.8	35.5	36.2	37.2	39.1	41.0	43.2	45.4	47.5
571	22.9	24.1	25.3	26.5	28.0	29.4	30.8	32.3	34.0	35.7	36.4	37.4	39.3	41.2	43.4	45.6	47.7
Super-Lite	18.4	19.3	20.3	21.3	22.4	23.6	24.8	25.9	27.3	28.6	29.2	30.0	31.5	33.1	34.8	36.5	38.3
Super-Targ	12.9	13.6	14.3	15.0	15.8	16.6	17.4	18.2	19.2	20.1	20.5	21.1	22.2	23.3	24.5	25.7	26.9
Super-Fld	18.5	19.5	20.5	21.5	22.6	23.8	25.0	26.1	27.5	28.9	29.4	30.2	31.8	33.3	35.1	36.9	38.6
Solo 1250	12.8	13.4	14.1	14.8	15.6	16.4	17.2	18.0	18.9	19.9	20.3	20.8	21.9	23.0	24.2	25.4	26.6
Pearl Scot	11.7	12.3	12.9	13.5	14.3	15.0	15.7	16.5	17.3	18.2	18.6	19.1	20.0	21.0	22.1	23.2	24.3
Royal Scot	9.8	10.3	10.8	11.4	12.0	12.6	13.2	13.8	14.6	15.3	15.6	16.0	16.8	17.7	18.6	19.5	20.4
Solo 1000	11.1	11.6	12.2	12.8	13.5	14.2	14.9	15.6	16.4	17.2	17.6	18.0	19.0	19.9	20.9	22.0	23.0
Solo 1500	14.2	14.9	15.7	16.4	17.3	18.2	19.1	20.0	21.0	22.1	22.5	23.1	24.3	25.5	26.8	28.2	29.5
Nobel 60	11.4	12.0	12.6	13.2	13.9	14.6	15.4	16.1	16.9	17.8	18.1	18.6	19.6	20.5	21.6	22.7	23.8
Nobel 62	12.7	13.4	14.1	14.7	15.5	16.3	17.2	18.0	18.9	19.8	20.2	20.8	21.8	22.9	24.1	25.3	26.5
Nobel 64	13.5	14.2	14.9	15.6	16.5	17.3	18.2	19.0	20.0	21.0	21.4	22.0	23.1	24.3	25.6	26.8	28.1
Nobel 78	10.3	10.9	11.4	12.0	12.6	13.3	13.9	14.6	15.3	16.1	16.4	16.9	17.7	18.6	19.6	20.5	21.5
Nobel 80	10.6	11.1	11.7	12.2	12.9	13.6	14.2	14.9	15.7	16.5	16.8	17.2	18.1	19.0	20.0	21.0	22.0
Nobel 82	11.5	12.1	12.7	13.3	14.0	14.7	15.5	16.2	17.0	17.9	18.2	18.7	19.7	20.6	21.7	22.8	23.9
Nitro 100	11.5	12.1	12.8	13.4	14.1	14.8	15.6	16.3	17.1	18.0	18.3	18.8	19.8	20.8	21.9	23.0	24.1

PONSNESS/WARREN POWDER CHARGE BUSHINGS

Bushing #	700-X	800-X	PB	SR 4756	SR 7625	IMR 4227	Red Dot	Green Dot	Blue Dot	Herco	Unique	2400	Bullseye	Clays	Int'l Clays	Universal Clays	HS-6	HS-7	H110	WSL	WST	WSF	296	540	571	Royal Scot	Solo 1000	Solo 1250	Solo 1500
1A	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	13.4	NR	NR	NR	13.5	NR	NR	NR	NR	NR	NR
2A	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	12.3	NR	NR	NR	NR	NR	NR	14.3	NR	NR	NR	14.5	NR	NR	NR	NR	NR	NR
3A	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	13.2	NR	NR	NR	NR	14.5	15.3	15.4	NR	NR	NR	15.6	NR	NR	NR	NR	NR	NR
A	NR	NR	NR	NR	NR	15.1	NR	NR	NR	NR	NR	15.2	NR	NR	NR	NR	16.8	17.6	17.8	NR	NR	NR	NR	17.2	NR	NR	NR	NR	NR
B	NR	NR	NR	NR	NR	15.9	NR	NR	NR	NR	NR	16.1	NR	NR	NR	NR	17.7	18.6	NR	NR	NR	NR	NR	18.2	19.1	NR	NR	NR	NR
C	NR	NR	NR	NR	11.7	16.7	NR	NR	NR	NR	NR	16.8	NR	NR	NR	12.5	18.5	19.5	NR	NR	NR	NR	NR	19.1	19.8	NR	NR	NR	NR
C1	NR	NR	NR	NR	12.2	17.5	NR	NR	NR	NR	NR	17.6	NR	NR	NR	13.0	19.4	20.4	NR	NR	NR	16.1	NR	20.7	20.7	NR	NR	NR	NR
D	NR	NR	NR	NR	12.7	18.1	NR	NR	NR	NR	NR	18.3	NR	NR	NR	13.2	20.2	21.1	NR	NR	NR	16.7	NR	21.5	21.5	NR	NR	NR	NR
D1	10.6	NR	12.2	13.5	13.1	18.8	NR	NR	16.4	12.3	12.6	19.0	NR	NR	11.7	14.0	20.9	21.9	NR	16.4	NR	17.3	NR	24.1	22.3	NR	NR	NR	NR
E	12.0	NR	13.7	15.1	14.8	21.1	NR	NR	18.4	13.8	14.2	21.3	16.2	NR	13.1	15.7	23.5	24.6	NR	18.9	NR	19.5	NR	25.1	25.0	NR	NR	13.2	NR
E1	12.5	NR	14.3	15.8	15.4	22.0	11.6	11.7	19.2	14.4	14.8	22.2	16.8	NR	13.7	16.2	24.5	25.7	NR	19.7	NR	20.4	NR	26.4	26.1	NR	NR	13.8	NR
E2	13.1	13.9	15.0	16.6	16.2	23.1	12.2	12.3	20.1	15.1	15.6	23.3	17.7	NR	14.4	17.2	25.7	26.9	NR	20.7	NR	21.4	NR	27.9	27.5	NR	NR	14.4	16.8
F	13.9	16.2	15.9	17.5	17.1	24.4	12.9	13.1	21.3	16.0	16.5	24.7	18.7	13.2	15.2	18.1	27.2	28.5	NR	21.9	NR	22.6	NR	29.0	29.1	NR	NR	15.5	17.7
F1	14.5	17.1	16.5	18.2	17.8	25.4	13.4	13.6	22.2	16.6	17.2	25.7	19.4	13.7	15.8	18.3	28.3	29.6	NR	NR	NR	23.5	NR	29.8	30.4	NR	NR	15.9	18.5
F2	14.8	17.4	16.8	18.5	18.1	25.8	13.7	13.8	22.6	16.9	17.5	26.1	NR	13.9	16.1	18.9	28.8	30.1	NR	NR	NR	23.9	NR	31.4	31.2	NR	NR	16.2	18.8
G	15.7	18.5	17.9	19.7	19.2	27.4	14.5	14.7	23.9	18.0	18.7	27.7	NR	14.8	17.1	20.2	30.5	32.0	NR	NR	NR	25.4	NR	32.1	32.8	NR	NR	17.2	20.0
G1	16.0	18.8	18.2	20.0	19.5	27.9	14.7	14.9	24.3	18.3	19.0	28.2	NR	15.1	17.3	20.6	31.1	32.5	NR	NR	NR	25.8	NR	34.2	33.3	NR	NR	17.5	20.3
H	17.1	20.0	19.3	21.3	20.8	29.6	15.7	15.9	25.9	19.5	20.2	30.0	NR	16.0	18.4	22.0	33.0	34.6	NR	NR	18.0	27.4	NR	35.9	35.5	NR	16.8	18.6	21.6
I	17.9	21.0	20.3	22.4	21.8	31.2	16.5	16.7	27.2	20.5	21.2	31.5	NR	16.8	19.4	22.8	34.7	36.3	NR	NR	19.5	28.8	NR	36.6	37.2	NR	17.7	19.5	22.7
J	18.3	21.4	20.8	22.9	22.2	31.8	16.8	17.0	27.7	20.9	21.7	32.2	NR	17.2	19.8	23.9	35.4	37.1	NR	NR	19.9	29.4	NR	37.7	38.0	NR	18.0	19.9	23.2
J1	18.8	22.1	21.4	23.5	22.9	32.7	17.3	17.5	28.5	21.5	22.3	33.1	NR	17.7	20.3	24.5	36.4	38.2	NR	NR	20.5	30.3	NR	38.4	39.1	NR	18.6	20.5	23.8
K	19.2	22.5	21.7	23.9	23.3	33.3	17.6	17.9	29.1	21.9	22.7	33.7	NR	18.0	20.7	24.8	37.1	38.8	NR	NR	20.8	30.8	NR	40.3	39.8	NR	18.9	20.9	24.3
L	20.2	23.6	22.9	25.3	24.5	35.0	18.5	18.8	30.6	23.0	24.0	35.5	NR	18.9	21.8	25.7	39.0	40.8	NR	NR	21.9	32.4	NR	42.2	41.8	16.7	19.9	22.0	25.6
M	21.1	24.7	23.9	26.5	25.6	36.6	19.4	19.6	31.9	24.0	25.0	37.1	NR	19.8	23.6	26.8	40.8	42.7	NR	NR	22.9	NR	NR	45.2	43.8	17.5	20.8	23.6	26.8
N	22.5	26.4	25.7	28.3	27.4	39.2	20.7	21.1	34.2	25.7	26.8	39.8	NR	21.2	24.4	28.2	43.6	45.7	NR	NR	NR	NR	NR	NR	47.0	19.0	22.2	24.7	28.6
O	22.8	26.7	25.9	28.6	27.7	39.6	20.9	21.3	34.5	26.0	27.1	40.2	NR	21.5	NR	28.5	44.1	46.2	NR	NR	NR	NR	NR	NR	47.5	19.2	22.5	25.1	28.9
P	23.3	27.2	26.5	29.2	28.3	40.4	21.3	21.8	35.2	26.5	27.6	41.1	NR	21.9	NR	NR	45.0	47.1	NR	NR	NR	NR	NR	NR	48.4	19.5	23.0	25.6	29.5
Q	23.8	27.8	27.1	29.8	28.8	41.2	21.9	22.3	36.0	27.1	NR	42.0	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	20.4	23.5	26.1	30.1
R	24.7	28.9	28.2	31.0	30.0	42.9	22.9	23.2	37.5	28.1	NR	43.8	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	21.2	24.5	27.1	31.3
S	25.1	29.3	28.7	31.5	30.4	NR	NR	23.6	38.1	28.8	NR	44.5	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	21.6	NR	27.6	31.8
T	26.9	31.4	30.6	33.6	32.6	NR	NR	25.3	40.7	30.7	NR	47.5	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	23.0	NR	29.6	34.0
U	28.2	32.8	32.0	35.2	34.1	NR	NR	26.5	42.5	32.1	NR	49.8	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	24.2	NR	30.9	35.5
V	29.0	33.8	33.0	36.3	35.2	NR	NR	NR	43.8	33.1	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	31.9	36.6
W	30.6	35.8	34.8	38.3	37.1	NR	NR	NR	46.5	34.9	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	33.6	38.8
X	NR	36.3	35.3	38.9	37.6	NR	NR	NR	47.2	35.4	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	39.4
Y	NR	38.0	37.1	40.8	39.5	NR	NR	NR	49.5	37.2	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	41.3
Z	NR	NR	41.6	45.8	44.3	NR	NR	NR	55.7	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	46.4

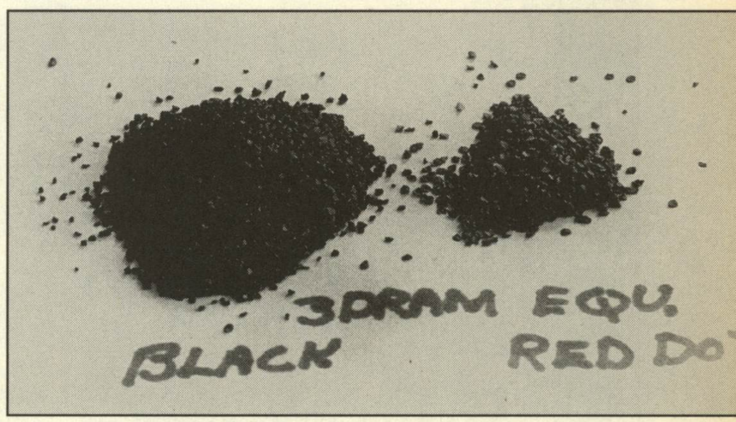
CHAPTER 14

Ballistics For The Shotgunner

THE WORLD OF internal and external ballistics is well founded in physics or carefully recorded experiences. There simply is no nonsense involved—that is except for the "dram equivalent" system used for rating shotshell performance.

About a century ago, all shotshells were loaded with blackpowder. After the introduction of smokeless propellants, the industry felt the need for a system to convey the relative power of these shotshell loadings to comparable blackpowder loads. The folks who devised the system somehow thought that specifying velocity and shot charge weights was unsatisfactory.

This was, at best, fragmented thinking. After all, the consumer had no problems relating velocity and bullet weight for rifle and handgun ammunition. Why wouldn't he understand the same information about shotshells? Having worked in the ammunition industry for a great many years, I speculate the problem was one of "me-tooing" the rifle and handgun ammo folks. This, despite the simplicity, logic and workability of the latter's approach.

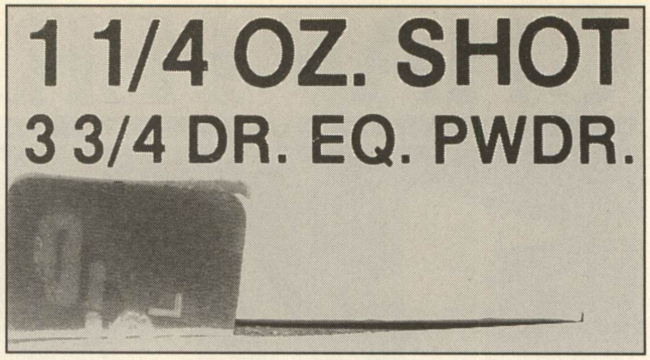


On the left is 3 drams of blackpowder. On the right is a charge of smokeless powder which will, under specific loading conditions, duplicate the velocity that could be obtained with the blackpowder charge. The reloader should never attempt to use a dram charge by volume of weight of smokeless powder, as doing so would be extremely hazardous. Also, never use smokeless powder in a gun designed for blackpowder—not ever!

The early shotshell manufacturers never found an answer to the imagined problem; they simply sold shotshells by gauge, shot charge weight and sometimes a reference to the powder charge used. Velocity? Forget it, you had to really be in the know to have a clue.

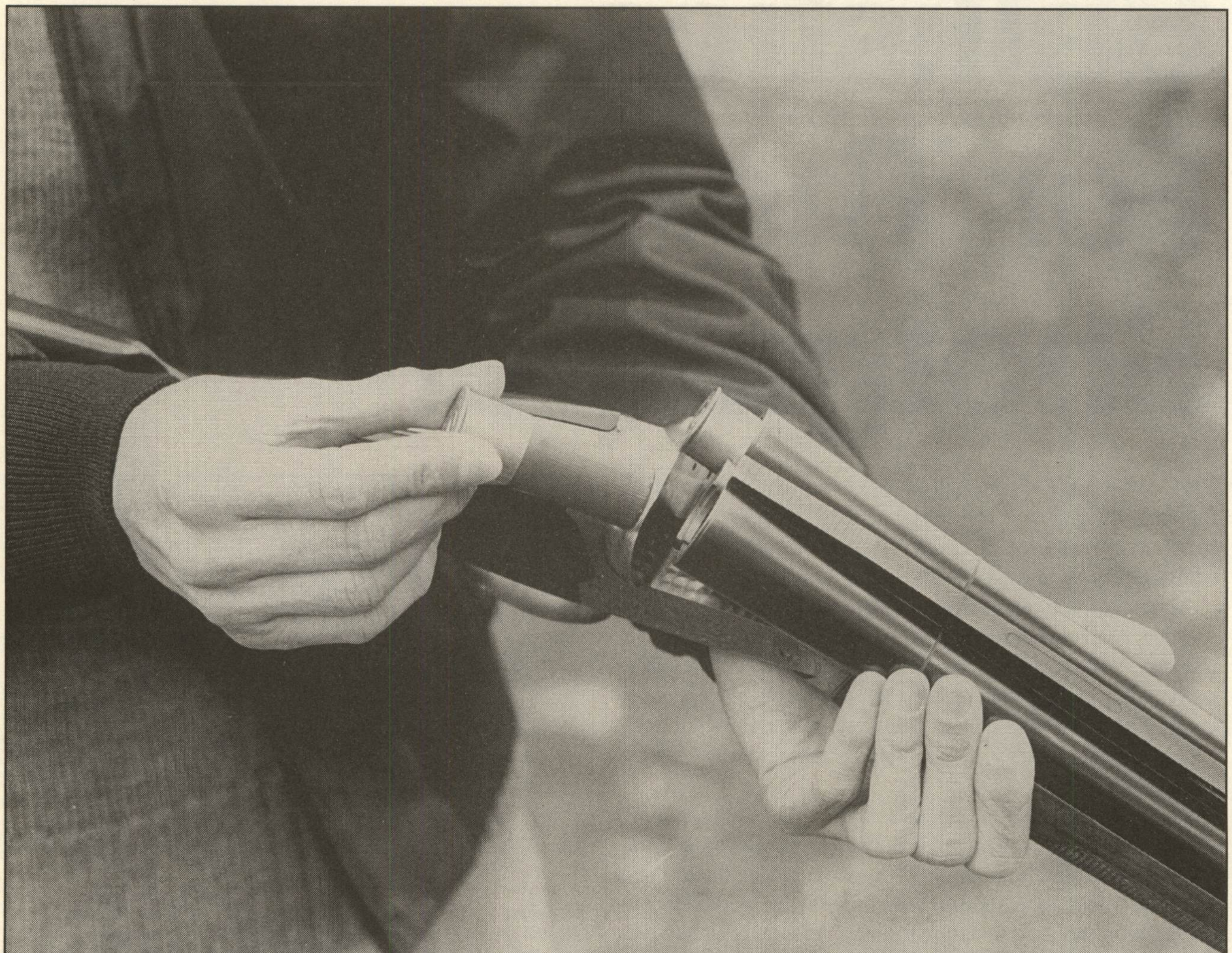
As the use of smokeless powder became more prevalent, blackpowder in shotshells quickly began to disappear, save for a few reloaders and those who owned shotguns unsuitable for smokeless powder. At this point, the marketing end of the industry decided the modern shooter needed a system that bridged the gap between blackpowder and smokeless loads so that the power of one could be made relative to the other. And work began on devising charts to relate smokeless powder loads to the almost now obsolete blackpowder shells. Talk about not wanting to let go!

Eventually, the industry approved the dram equivalent rating. Regrettably, the system was not only a throwback to the nearly forgotten blackpowder days, but caused more confusion than could have been imagined by those who designed it. Unfortunately, it is still in use today and even has supporters within the industry.

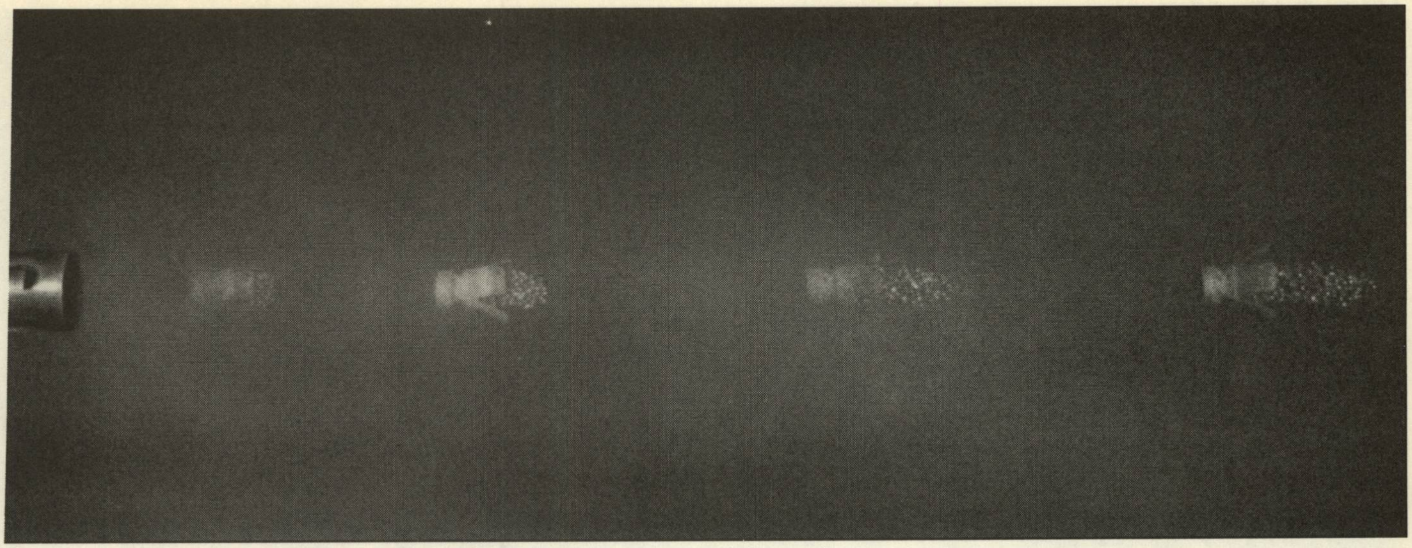


Modern shotshell boxes are usually marked with dram equivalent ratings. This is done with little justification as it serves more to confuse rather than assist the shooter.

Few shotgunners understand dram equivalent ratings. Indeed, extensive research from as far back as the 1960s shows most shotgunners simply purchase a box of duck or squirrel loads, or whatever. The more sophisticated shooters, reloaders and those who have bothered to delve into shotshell ballistics will know to ask for a specific gauge and shot charge weight of a specific shot size. A duck hunter might



When using shotshells, today's shooters need to know gauge, shell length, shot size and charge weight, as well as velocity. Who cares about dram equivalent?



This is a Winchester charge of $1^1/_8$ ounces being propelled from a target load at 1200 feet per second. Note how quickly the AA wad opens and begins to fall away from the shot column.

even specify a box of $2^3/_4$-inch 12-gauge shells with $1^1/_2$ ounces of #4s. And some shooters may readily recognize the difference in brand names which suggest a high- or standard-velocity load.

Still, only a select few can explain the meaning of a box marked $3^3/_4$—$1^1/_4$—$7^1/_2$ or $3^1/_4$—$1^1/_8$—6, let alone interpret MAX—$1^1/_8$—$7^1/_2$. Yet, that is exactly how most boxes of shotshells are labeled—as an "aid" in identifying a load.

As adopted by the industry nearly a century ago, the definition for "dram equivalent" is as follows: *Dram Equivalent—The accepted method of correlating relative velocities of shotshells loaded with smokeless propellant to shotshells loaded with blackpowder.* The blackpowder load referenced in the definition was a 3-dram charge of blackpowder with $1^1/_8$ ounces of shot, giving a muzzle velocity of 1200 fps. But, $1^1/_4$ ounces of shot at 1165 fps would also be a 3-dram equivalent loading. Further, a $3^1/_4$ dram equivalent load might have $1^1/_8$ ounces of shot and a velocity of 1255 fps.

As can be seen, the system is notable for its ambiguity and creates more questions than it answers. It assumes the shooter knows that the definition applies only to 12-gauge loads and that different velocities would result from 16- or 20-gauge loads using identical charges of blackpowder and shot. Further, no general reference material is available explaining the commonly used abbreviations or words that often replace numerical dram equivalent ratings. These are MAX—Maximum, MAG—Magnum, and so on.

If you understand industry loading practices, you know it is impossible to accurately define such terms, as they vary in application and usage almost as a whim.

Ignored by the industry is that the official dram equivalent rating definition never referenced a specific blackpowder granulation size (Fg, FFg, FFG, FFFG) or, for that matter, the name of the manufacturer. They assumed you knew that they meant FFg. If you did, were you also supposed to know that FFg powder produced differing ballistics from manufacturer to manufacturer?

At this point, you may begin to wonder why today's shotgunner should even care about the nuances of the blackpowder information.

In defense of some in the industry, attempts have been made since the 1960s to get rid of the dram equivalent rating system. But each effort has failed. I served on one committee in the late 1970s, and I can honestly tell you the reasoning used for rejecting the proposed change bears no more resemblance to common sense than did the original dram equivalent rating concept. A few industry personnel can speak "dram" while thinking feet per second, but fail to understand the shooter's confusion. Nonetheless, a ballistician's ability does nothing to help the average ammunition user.

Is the perpetuation of the dram equivalent rating system assured? The system has been with us for so long it won't be easy to kill. Some believe the problem is unsolvable, or it would have been changed long ago.

Unfortunately, today's shotgunner/reloader needs to have some understanding of dram equivalent gobbledygook in order to sort all of the various factory loads into an understandable array of choices that can be duplicated with reloads. Then, the shooter can begin to think intelligently in terms of shot weight and velocity—just as is done with rifle and handgun ammunition. While it would be logical and responsible, not to mention practical, to list shotshells by gauge and shell length (caliber), shot charge weight (bullet weight) and velocity, it probably will not become common practice in the near future. We should be so lucky to see a box of shotshells marked: 12-ga., $2^3/_4$", $1^1/_2$ ozs., 1260 fps, or simply 12—$2^3/_4$—$1^1/_2$—1260. Hey SAAMI and ammo makers, what's confusing about that?

Eventually, the change may be made. In fact, in recent years, a slightly encouraging trend has surfaced. Manufacturers are now listing shotshell velocities in their catalogs.

I believe a number of reloading accidents could have been avoided if the dram equivalent system had never seen the light

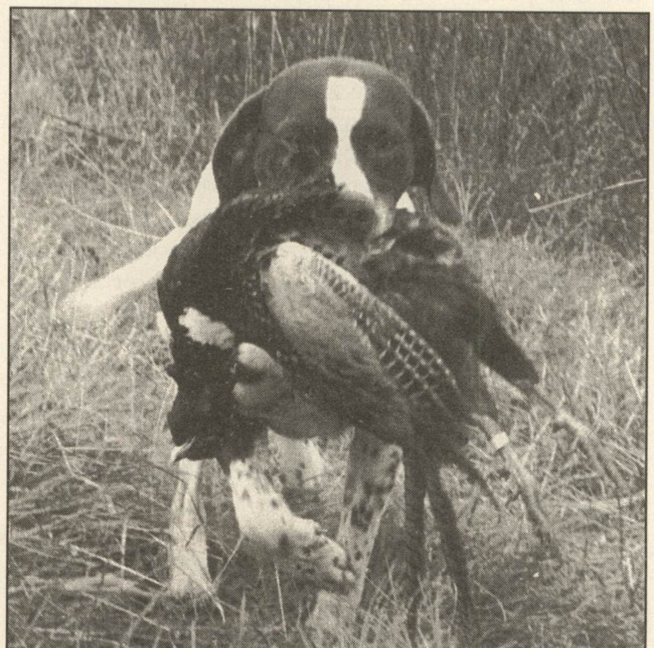
Regardless of the choice of shotgun or barrel length, shotshells of a specific lot will deliver rather uniform field performance.

of day. More than a few reloaders have failed to realize the dram rating referred to blackpowder and have loaded dram charges of smokeless powders with disastrous results.

To help relate velocities to the ammo boxes marked with the dram system, Table I shows dram equivalent numerical ratings versus velocities. As you see, the ratings differ depending on the selected gauge. Obviously, a 20-gauge 3-inch shell charged with $1^1/_4$ ounces of shot is not the ballistic equivalent of a 12-gauge shell using the same $1^1/_4$ ounces of shot. Other similar misconceptions will be cleared up.

Interpreting the ratings on ammo boxes requires that shell gauge and length be isolated. Then break down the remaining numbers containing three bits of information. For example, take a 12-gauge, $2^3/_4$-inch load marked "$3^1/_4$—$1^1/_8$—$7^1/_2$." The first number refers to the dram equivalent rating; the second is the shot charge weight in ounces; the third is the shot size.

By using the appropriate table for gauge and shot charge weight, the specific velocity of a dram equivalent rating can be found. With enough practice, you may be able to think velocity when you know the gauge, shot weight and dram equivalent rating, much as many shooters know that a 30-30, 170-grain factory load has an advertised velocity of 2200 fps. Loads without numbers are those for which a specific velocity rating was never decided upon, although it can be estimated.



The hunter's success in the field will depend mostly on the choice of shot size and shot charge weight rather than on a specific muzzle velocity.

TABLE I

Approximate Dram Equivalent Rating Velocity in Feet per Second

10-Gauge

Shot Wt. (oz.)	Dram Equivalent Rating: 3 3/8	3 1/2	3 5/8	3 3/4	3 7/8	4	4 1/8	4 1/4	4 3/8	4 1/2	4 5/8	4 3/4	4 7/8	5
	Equivalent Velocity													
1 1/4	1200	1225	1250	1270	1295	1315	1340	1360	1385	1405	1430	1450	1475	1495
1 3/8	-	1200	1225	1245	1265	1290	1315	1335	1360	1380	1405	1425	1450	1470
1 1/2	-	1175	1200	1220	1245	1265	-	1310	-	1355	-	1400	-	1445
1 5/8	-	1150	-	1195	-	1240	1265	1285	-	1330	-	1375	-	1420
1 3/4	-	1125	-	1170	-	1215	-	1260	-	1305	1330	1350	-	1395
1 7/8	-	1100	-	1145	-	1190	-	1235	1260	1280	-	1325	-	1370
2	-	1075	-	1120	-	1165	-	1210	-	1255	-	1300	1325	1345
2 1/8	-	1050	-	1095	-	1140	-	1185	-	1230	-	1275	-	1320
2 1/4	-	1025	-	1070	-	1115	-	1165	-	1205	-	-	-	-

12-Gauge

Shot Wt. (oz.)	Dram Equivalent Rating: 2 1/2	2 5/8	2 3/4	2 7/8	3	3 1/8	3 1/4	3 3/8	3 1/2	3 5/8	3 3/4	3 7/8	4	4 1/8
	Equivalent Velocity													
1	1130	1155	1180	1205	1235	1260	1290	1315	1345	1380	1400	1430	1455	-
1 1/8	1100	1120	1145	1170	1200	1225	1255	1280	1310	1335	1365	1390	1420	-
1 1/4	1055	1080	1110	-	1165	1190	1220	-	1275	-	1330	-	1385	1410
1 3/8	-	-	1075	-	1130	-	1185	1210	1240	-	1295	-	1350	-
1 1/2	-	-	1040	-	1095	-	1150	-	1205	-	1260	-	1315	-
1 5/8	-	-	1005	-	1060	-	1115	-	1170	-	1225	-	1280	-
1 3/4	-	-	970	-	1025	-	1080	-	1135	-	1190	-	1245	-
1 7/8	-	-	-	-	-	-	-	-	-	-	1155	-	1210	-
2	-	-	-	-	-	-	-	-	-	-	1120	-	1175	-

16-Gauge

Shot Wt. (oz.)	Dram Equivalent Rating: 2 1/4	2 3/8	2 1/2	2 5/8	2 3/4	2 7/8	3	3 1/8	3 1/4
	Equivalent Velocity								
7/8	1145	1170	1200	-	1255	-	1310	-	1365
1	1110	1135	1165	1190	1220	-	1275	1300	1330
1 1/8	1075	1100	1130	1150	1185	1210	1240	-	1295
1 1/4	1040	-	1095	-	1150	-	1205	1230	1260

20-Gauge

Shot Wt. (oz.)	Dram Equivalent Rating: 2	2 1/8	2 1/4	2 3/8	2 1/4	2 5/8	2 3/4	2 7/8	3
	Equivalent Velocity								
3/4	1145	-	-	-	-	-	-	-	-
7/8	1100	1125	1155	-	1210	1235	1265	-	1320
1	1055	-	1110	1135	1165	-	1220	-	1275
1 1/8	1010	-	1065	-	1120	-	1175	1200	1230
1 1/4	-	-	-	-	1075	-	1130	-	1185

28-Gauge

Shot Wt. (oz.)	Dram Equivalent Rating: 1 3/4	1 7/8	2	2 1/8	2 1/4	2 3/8
	Equivalent Velocity					
3/4	1115	1160	1205	1250	1295	-
7/8	1070	1115	1160	1205	1250	1295
1	1025	-	1115	1160	1205	1250

410-Bore

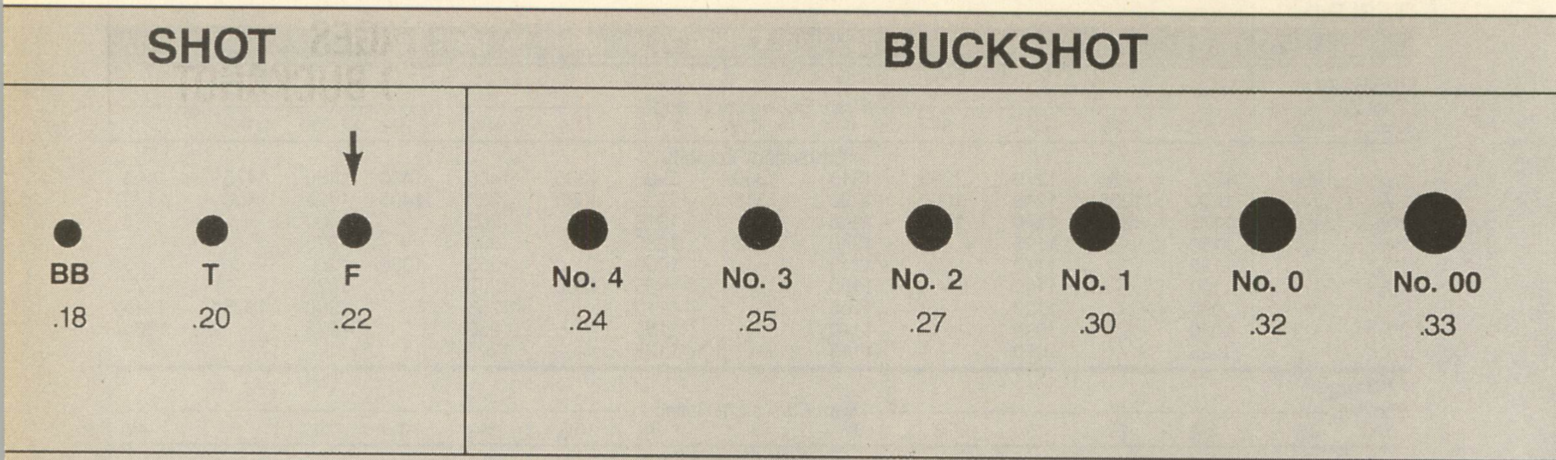
Shot Wt. (oz.)	Dram Equivalent Rating: 1 3/8	1 1/2	1 5/8
	Equivalent Velocity		
1/2	1125	1200	1275
5/8	1050	1140	1210
3/4	-	1080	1155

Maximum (MAX) or Magnum (MAG) are often substituted for the first set of digits in the dram equivalent rating, i.e. MAG—1 7/8—BB. The word MAG has no more meaning than to suggest the velocity level that the listed shot weight is commonly loaded. For 1 7/8 ounces of shot in a 12-gauge shell, this is 1210 fps. The MAG in no way should be interpreted as meaning the maximum possible velocity, or the maximum possible powder charge, or even the maximum allowable pressure level. Maximum (MAX), as in MAX—1 1/4—4 on a 12-gauge box, would be equivalent to 3 3/4 or 1330 fps. Thus, the word codes used in the dram equivalent rating are, or at least can be, less informative, or more misleading, than the numerical ratings.

Remember, the actual velocity obtained with a box of shells may not duplicate dram equivalent velocity. It is not uncommon for actual average velocities to vary by about 35 fps from the nominal advertised velocity.

Shotshell Ballistics

All of the factory shell ballistics tables in this book are nominal values as established by ammunition manufacturers. Shotshell ballistics are, generally speaking, uniform from shotgun to shotgun. However, some variation, due to component lots, manufacturing processes or barrel length, will occur.



(Diameter in inches, actual size.)

The large pellet sizes are not generally reloaded as they have limited applications. Some will reload 0 and 00 buckshot for deer hunting where demanded by local law.

The 12-gauge is extremely versatile and can be loaded in three shell lengths (2¾- 3-, and now 3½-inch shells) as well as with many shot charge weights (1, 1⅛, 1¼, 1⅜, 1½, 1⅝, 1¾, 1⅞ and 2 ounces) as well as almost every shot size from #11 to 000 buckshot.

In actual use, performance at normal shotgun ranges will not differ noticeably whether the shooter employs a 21-inch or 32-inch barrel. However, for those interested parties, the ballistics tables contained herein are based on barrel lengths as follows:

10-gauge: 32-inch barrel
12-gauge: 30-inch barrel
16-gauge: 28-inch barrel
20-gauge: 26-inch barrel
28-gauge: 26-inch barrel
410-bore: 26-inch barrel

For actual velocity change due to barrel length, Table II will give a very close approximation.

TABLE II

Shotshell Velocity vs. Barrel Length

Slug and Buckshot Loads

Gauge	Nominal Bbl. Length (ins.)	Applicable Bbl. Length (ins.)	Change in Velocity for Each 1-inch Change in Nominal Barrel Length (fps)
10	30	32-22	8
12	30	32-22	8
16	28	30-20	8
20	26	30-20	8
28	26	28-20	8
410-bore	26	28-20	12

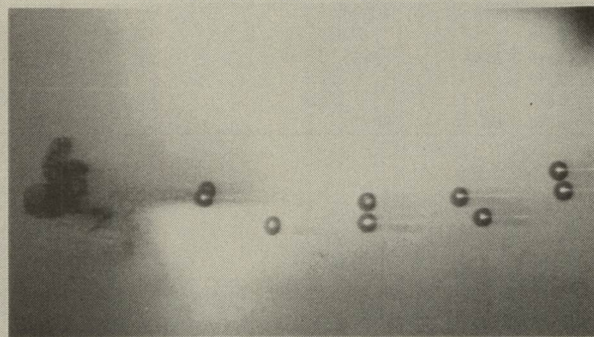
Pellet Sizes #11 through BB

Gauge	Nominal Bbl. Length (ins.)	Applicable Bbl. Length (ins.)	Change in Velocity for Each 1-inch Change in Nominal Barrel Length (fps)
10	30	32-22	5
12	30	32-22	5
16	28	30-20	8
20	26	30-20	8
28	26	28-20	12
410-bore	26	28-20	12

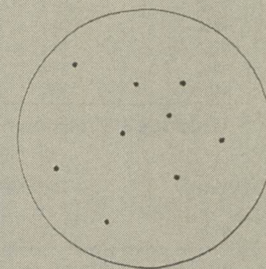
BALLISTIC PHOTOGRAPHY SHOWS ADVANTAGES OF FEDERAL PREMIUM™ BUCKSHOT OVER STANDARD BUCKSHOT

Premium™ Buckshot

At 1 foot from muzzle shot pellets and buffer emerge from shot cup.



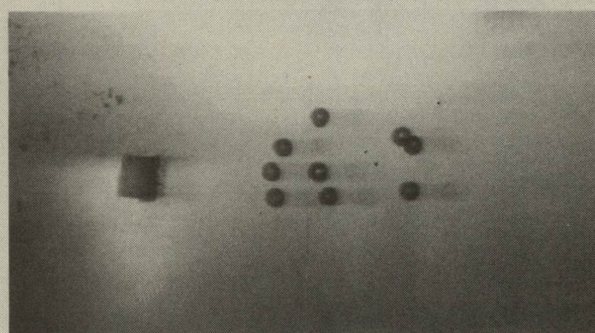
At 6 feet from muzzle minimum dispersion of pellets and superior sphericity are apparent.



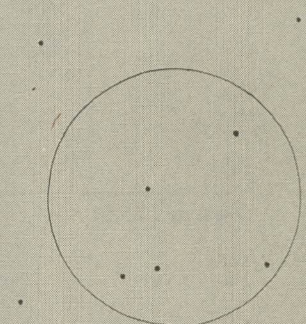
Typical 15" circle pattern at 40 yards from full choke shows density achieved by Premium™ brand 9-pellet 00 buckshot.

Standard Buckshot

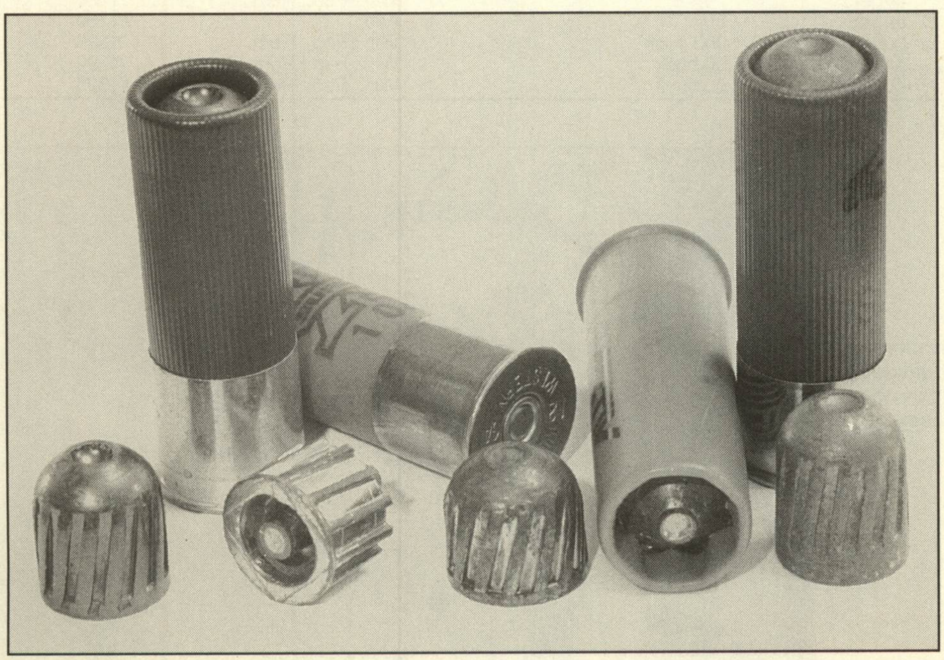
One foot from muzzle



Six feet from muzzle



Typical 15" circle pattern at 40 yards from full choke with standard 9-pellet 00 buckshot.



Shotgun slugs come in many varieties. The shooter should try several to obtain the best possible accuracy in a specific shotgun.

TABLE III

Factory Loaded Shotshell Specifications

Dram Equivalent	Shot (oz.)	Load Style	Shot Size	Available Brands	Velocity (fps)
10-Gauge 3½″ Magnum					
4½	2¼	premium	BB, 2, 4, 6	Win., Fed., Rem.	1205
4½	2¼	premium	4, 6	Win., Fed.	1205
Max	54 pellets	premium	4 buck	Win.	1100
4¼	1¾	steel	T, BBB, BB, 1, 2, 3	Win., Rem.	1260
4¼	1¾	steel duplex	TxBB, BBBx1	Rem.	1260
4¼	1⅝	steel	F, T, BBB	Win.	1285
4⅝	1⅝	steel	F, T, BBB	Win., Fed.	1350
Max	1¾	slug, rifled	slug	Fed.	1280
12-Gauge 3½″ Magnum					
Max	2¼	premium	4, 6	Fed., Rem., Win.	1150
Max	18 pellets	premium	00 buck	Fed.	1100
4⅛	1 9/16	steel	F, T, BB, 1, 2	Win., Fed.	1335
4⅛	1 9/16	steel	F, T, BBB	Win.	1335
12-Gauge 3″ Magnum					
4	2	premium	BB, 2, 4, 5, 6	Win., Fed., Rem.	1175
4	2	duplex	4x6	Rem.	1175
4	1⅞	premium	BB, 2, 4, 6	Win., Fed., Rem.	1210
4	1⅞	duplex	BBx4, 2x4, 2x6, 4x6	Rem.	1210
4	1⅝	premium	2, 4, 5, 6	Win., Fed., Rem.	1290
4	24 pellets	buffered	1 buck	Win., Fed.. Rem.	1040
4	15 pellets	buffered	00 buck	Win., Fed., Rem.	1210
4	10 pellets	buffered	000 buck	Win., Fed., Rem.	1225
4	41 pellets	buffered	4 buck	Win., Fed., Rem.	1210
Max	1¼	slug, rifled	slug	Fed.	1600
Max	1	slug, rifled	slug, magnum	Rem.	1760
Max	1	saboted slug	slug	Win.	1550
3⅝	1⅜	steel	F, T, BBB, BB, 1, 2, 3, 4	Win., Fed., Rem.	1275
3⅝	1⅜	steel duplex	BBBx1, BBx2, 1x3	Rem.	1275
4	1¼	steel	F, T, BBB, BB, 1, 2, 3, 4, 6	Win., Fed., Rem.	1375
12-gauge 2¾″					
Max	1⅝	magnum	4, 5, 6	Win.	1250
3¾	1½	magnum	BB, 2, 4, 5, 6	Win., Fed., Rem.	1260
3¾	1½	duplex	BBx4, 2x4, 2x6, 4x6	Rem.	1260
3¾	1¼	high velocity	BB, 2, 4, 5, 6, 7½, 8, 9	Win., Fed., Rem.	1330
3½	1¼	mid velocity	7, 8, 9	Win.	1275
3¼	1¼	std. velocity	6, 7½, 8, 9	Win., Fed., Rem.	1220
3¼	1⅛	std. velocity	4, 6, 7½, 8, 9	Win., Fed., Rem.	1255
3¼	1	std. velocity	6, 7½, 8	Rem., Fed.	1290
3¼	1¼	target	7½, 8, 9	Win., Fed., Rem.	1220
3	1⅛	target	7½, 8, 9, 7½x8	Win., Fed., Rem.	1200
2¾	1⅛	target	7½, 8, 8½, 9, 7½x8	Win., Fed., Rem.	1145
2¼	1⅛	target	7½, 8, 8½, 9	Rem., Fed.	1080
3½	1	target	10	Fed.	1350
3¼	1	target	7½, 8, 9	Win., Fed., Rem.	1290
2¾	1	target	8½	Fed.	1180
3¾	8 pellets	buffered	000 buck	Win., Fed., Rem.	1325
4	12 pellets	premium	00 buck	Win., Fed., Rem.	1290
3¾	9 pellets	buffered	00 buck	Win., Fed., Rem.	1325

For the best possible accuracy with rifled slugs, the shooter should select a 12-gauge shotgun equipped with rifle-style sights and preferably one of the newer fully rifled barrels.

TABLE III CON'T.

Factory Loaded Shotshell Specifications

Dram Equivalent	Shot (oz.)	Load Style	Shot Size	Available Brands	Velocity (fps)
12-gauge 2¾" con't.					
3¾	12 pellets	buffered	0 buck	Win., Fed., Rem.	1275
4	20 pellets	buffered	1 buck	Win., Fed., Rem.	1075
3¾	16 pellets	buffered	1 buck	Win., Fed., Rem.	1250
4	34 pellets	premium	4 buck	Win., Fed., Rem.	1250
3¾	27 pellets	buffered	4 buck	Win., Fed., Rem.	1325
Max	1	saboted slug	slug	Win., Fed.	1500
Max	1¼	slug, rifled	slug	Fed.	1520
Max	1	slug, rifled	slug, magnum	Rem.	1680
Max	1	slug, rifled	slug	Win., Fed., Rem.	1610
3½	1¼	steel	T, BBB, BB, 1, 2, 3, 4, 5, 6	Win., Fed., Rem.	1300
3½	1¼	steel duplex	BBx2, 1x3	Rem.	1300
3¾	1⅛	steel	BB, 1, 2, 3, 4, 5, 6	Win., Fed., Rem.	1365
3¾	1⅛	steel duplex	BBx1, BBx2, BBx4, 1x3, 2x6	Rem.	1365
3¾	1	steel	2, 4, 6	Win., Fed.	1390
16-Gauge 2¾"					
3¼	1¼	magnum	2, 4, 6	Win., Fed., Rem.	1260
3¼	1⅛	high velocity	4, 6, 7½	Win., Fed., Rem.	1295
2¾	1⅛	std. velocity	6, 7½, 8	Fed., Rem.	1185
2½	1	promotional	6, 7½, 8	Win., Fed., Rem.	1165
Max	15/16	steel	2, 4	Fed.	1300
Max	⅞	steel	2, 4	Win.	1300
3	12 pellets	buffered	1 buck	Win., Fed., Rem.	1225
Max	⅘	slug, rifled	slug	Win., Fed., Rem.	1570
20-Gauge 3" Magnum					
3	1¼	premium	2, 4, 6, 7½	Win., Fed., Rem.	1185
Max	18 pellets	buckshot	2 buck	Fed.	1200
Max	24 pellets	buffered	3 buck	Win.	1150
2¾	20 pellets	buck	3 buck	Rem.	1200
3¼	1	steel	1, 2, 3, 4, 5, 6	Win., Fed., Rem.	1330
20-Gauge 2¾"					
2¾	1⅛	magnum	4, 6, 7½	Win., Fed., Rem.	1175
2¾	1	high velocity	4, 5, 6, 7½, 8, 9	Win., Fed., Rem.	1220
2½	1	std. velocity	6, 7½, 8	Rem., Fed.	1165
2½	⅞	promotional	6, 7½, 8	Win., Rem.	1210
2½	⅞	target	8, 9	Win., Fed., Rem.	1200
Max	20 pellets	buffered	3 buck	Win., Fed.	1200
Max	⅝	slug, saboted	slug	Win.	1400
2¾	⅝	slug, rifled	slug	Rem.	1580
Max	¾	slug, rifled	slug	Win., Fed.	1570
Max	¾	steel	4, 6	Win., Fed.	1425
28-Gauge 2¾"					
2	1	high velocity	6, 7½, 8	Win.	1125
2¼	¾	high velocity	6, 7½, 8	Win., Fed., Rem.	1295
2	¾	target	9	Win., Fed., Rem.	1200
410-Bore 3"					
Max	11/16	high velocity	4, 5, 6, 7½, 8, 9	Win., Fed., Rem.	1135
410-Bore 2½"					
Max	½	high velocity	4, 6, 7½	Win., Fed., Rem.	1245
Max	⅕	slug, rifled	slug	Win., Fed., Rem.	1815
1½	½	target	9	Win., Fed., Rem.	1200

Factory Shotshells

The nominal muzzle velocity specifications for factory shotshells are shown in Table III. On occasion, a manufacturer may opt to load to a somewhat different velocity than that shown.

Pellet Size Versus Ballistics

The most basic variation in downrange shotshell ballistics is caused by pellet size. For example, a lead #2 pellet leaving the muzzle at 1330 fps has a velocity of 735 fps at 60 yards. A lead #7½ pellet starting out at the same 1330 fps has a velocity of 585 fps at 60 yards, some 150 fps less than the larger pellet. Heavier objects simply lose their velocity slower.

Pellet energy, naturally, will also be substantially different. Table IV applies to lead shot only. Steel shot, due to its lower density, will lose velocity more rapidly than lead, and energy fall-off will occur more quickly. For more on steel shot, see page 278.

The range of velocities shown in Table IV is necessarily restricted. We simply could not list every possible combination. However, enough information is shown for a good understanding of velocity versus shot size. Obviously, shot size is more essential to maintaining downrange velocity than the initial velocity of the load.

For example, a #7½ pellet leaving the muzzle at 1330 fps

TABLE IV

Exterior Lead Pellet Ballistics

Shot Size	Velocity (fps) Muzzle	20 yds.	40 yds.	60 yds.	Energy (fpe) Muzzle	20 yds.	40 yds.	60 yds.
2	1330	1050	865	735	19.8	12.3	8.6	6.0
	1295	1030	850	725	19.0	11.9	8.1	5.9
	1220	980	820	700	16.6	10.7	7.5	5.5
	1200	975	815	690	16.1	10.6	7.4	5.3
4	1330	1015	820	690	13.2	7.7	5.0	3.6
	1295	996	805	680	12.6	7.4	4.9	3.5
	1220	950	780	660	11.1	6.8	4.6	3.3
	1200	940	770	655	10.8	6.6	4.4	3.2
	1185	925	760	645	10.1	6.2	4.1	3.0
	1165	915	750	635	9.7	6.0	4.0	2.9
	1135	895	740	630	9.3	5.7	3.9	2.8
5	1330	995	795	665	10.1	5.7	3.6	2.5
	1295	975	785	655	9.6	5.4	3.5	2.4
	1220	935	755	635	8.5	5.0	3.3	2.3
	1200	920	745	630	8.2	4.8	3.2	2.2
6	1330	975	770	635	7.8	4.2	2.6	1.8
	1295	955	755	625	7.4	4.0	2.5	1.7
	1220	915	730	615	6.6	3.7	2.4	1.7
	1200	905	725	605	6.4	3.6	2.3	1.6
7½	1300	935	720	585	5.0	2.5	1.5	1.0
	1295	915	710	580	4.8	2.4	1.4	1.0
	1220	880	685	565	4.2	2.2	1.3	0.9
	1200	870	680	560	4.1	2.2	1.3	0.9
9	1200	820	625	505	2.4	1.1	0.6	0.4

Energy Figures Are Per Pellet

arrives at the 40-yard mark traveling at 720 fps, while a #6 pellet starting at 130 fps less muzzle velocity (1220 fps) arrives at the 40-yard mark with a nearly identical velocity of 725 fps.

Target Energy Absorption

To determine the total energy absorbed by the target, multiply the number of pellets placed on a silhouette target at the range of interest by the listed energy. For example, if your shot column leaves the muzzle at 1330 fps and you can place five of your #2 pellets into the target at 40 yards, then the total energy transferred to the target would be 43 foot pounds (8.6 listed energy for 40 yards multiplied by five).

Pellet Trajectory

The drop (trajectory) of shot, rounded to the nearest inch, is such that all shot sizes from #2 to #7½ have nearly identical drops when used at normal muzzle velocities of 1150 to 1330 fps. At 20 yards, pellet drop is ½- to 1-inch; at 40 yards, it is 3 to 4 inches; while at 50 yards, it ranges from 7 to 12 inches. With effective pattern diameters being about 36 inches, trajectory of shot doesn't become important until the range exceeds 40 to 45 yards. At 45 to 60 yards, it may be beneficial to hold 6 to 12 inches high, depending on one's ability to judge range and the required holdover. But, most expert shotgunners simply ignore pellet trajectory at all ranges, perhaps rightly so. Errors involved in estimating range and holdover are often greater than the actual amount of drop for which the shooter is trying to compensate.

Slug And Buckshot Ballistics

Tables VI, VII, and VIII detail exterior slug and buckshot ballistics. While slug data is shown to 100 yards, this range may exceed the practical accuracy limitations of any specific slug and barrel combination. Sportsmanship suggests the maximum range for slugs is that at which you can keep all of your shots within a 6-inch circle. Naturally, when using slugs, rifle-type sights should be used.

When hunting deer, buckshot is usually not sporting (truly effective) at ranges past 25 yards. The 30- and 40-yard data should not be construed as a suggestion to use buckshot at such ranges.

Slug performance is frequently a topic of in-depth discussion. However, such discussions can be reduced most simply to the table showing actual performance in typical sight-equipped shotguns. The guns used to develop the data were a Remington Model 870 and an Ithaca Model 37, both equipped with factory slug barrels using open sights. Not every available slug was tested, but those shown are both popular and representative of available ammunition. It should be noted that only 12-gauge slugs delivered sufficient energy and accuracy for 100-yard shooting. At that, only some 12-gauge slugs meet the 6-inch accuracy criterion usually considered acceptable.

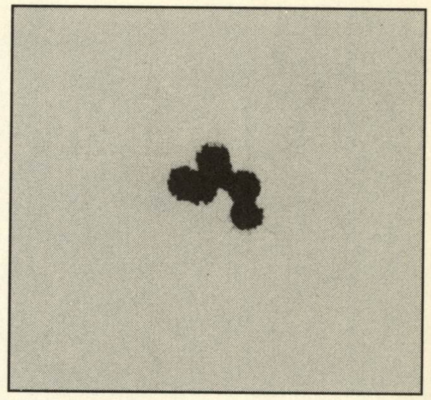
It is important to try several slug brands and styles when testing for accuracy. Some shotguns will show a strong preference for one style of slug over another, despite being used in another gun of the same make and model.

How Far Will A Shotgun Shoot

Shooters seldom have a firm idea of the distance that buckshot, slugs and pellets will travel, and it is usually quite a bit more than they assume. It is important to know how far a projectile will carry so you can avoid accidents. Table VIII shows the expected distance a shotgun projectile will travel under specific conditions. In certain circumstances, the distances can be greater, i.e. higher muzzle velocity, heavier projectile

TABLE V

Pellet Time in Flight and Trajectory							
		—Time in Flight (seconds)—			—Drop (ins.)—		
Shot Size	MV (fps)	20 yds.	40 yds.	60 yds.	20 yds.	40 yds.	60 yds.
#4	1360	.051	.117	.196	0.5	2.6	7.4
#5	1360	.052	.119	.202	0.5	2.7	7.8
#6	1360	.053	.122	.208	0.5	2.9	8.3
BB	1330	.050	.111	.182	0.5	2.4	6.4
#2	1330	.051	.115	.191	0.5	2.6	7.0
#4	1330	.052	.119	.199	0.5	2.7	7.7
#5	1330	.053	.121	.205	0.5	2.8	8.1
#6	1330	.054	.124	.211	0.6	3.0	8.6
#71/2	1330	.055	.129	.223	0.6	3.2	9.6
BB	1315	.051	.112	.183	0.5	2.4	6.5
#2	1315	.052	.116	.192	0.5	2.6	7.1
#4	1315	.053	.120	.201	0.5	2.9	7.8
#5	1315	.053	.122	.206	0.6	2.9	8.2
#6	1315	.054	.125	.212	0.6	3.0	8.7
#2	1295	.053	.117	.194	0.5	2.6	7.8
#4	1295	.053	.121	.203	0.6	2.8	8.0
#5	1295	.054	.124	.208	0.6	2.9	8.4
#6	1295	.055	.126	.215	0.6	3.1	8.9
71/2	1295	.056	.132	.227	0.6	3.3	9.0
BB	1255	.053	.116	.189	0.5	2.6	6.9
#2	1255	.054	.120	.199	0.6	2.8	7.7
#4	1255	.055	.124	.207	0.6	3.0	8.3
#5	1255	.056	.126	.213	0.6	3.1	8.7
#6	1255	.056	.129	.219	0.6	3.2	9.2
#8	1255	.058	.137	.236	0.6	3.6	10.7
#2	1240	.055	.121	.201	0.6	2.8	7.8
#4	1240	.056	.125	.209	0.6	3.0	8.4
#5	1240	.056	.128	.215	0.6	3.1	8.9
#6	1240	.057	.130	.221	0.6	3.3	9.4
#71/2	1240	.058	.136	.133	0.6	3.6	10.5
#4	1235	.056	.127	.210	0.6	3.0	8.5
#5	1235	.056	.128	.215	0.6	3.2	8.9
#6	1235	.057	.131	.221	0.6	3.3	9.4
#8	1235	.059	.138	.238	0.7	3.7	11.0
#2	1220	.055	.123	.203	0.6	2.9	8.0
#4	1220	.056	.127	.212	0.6	3.1	8.6
#5	1220	.057	.129	.217	0.6	3.2	9.1
#6	1220	.058	.132	.223	0.6	3.6	9.6
#7½	1220	.059	.137	.235	0.7	3.6	10.2
#8	1220	.059	.139	.240	0.7	3.8	11.1



This 50-yard group was fired using a rifled barrel and Winchester slugs.

weight, balled pellets, ricochets, etc. The safe shooter always allows extra distance.

Shotshell Pressure And Velocity Testing

Shotshell pressures and velocities have been traditionally measured using a test barrel made to minimal dimensions and mounted in a universal receiver. The barrel is drilled through at the chamber and a piston fitted into this hole. A lead crusher is then placed on top of the piston, which is held into place by an anvil.

Tested ammunition is lanced so the hole in the case can be precisely lined up with the piston hole in the barrel. When the gun is fired, the pressure in the case works equally on the base of the wad/shot column and the base of the piston. As the piston is driven upward, it crushes the lead cylinder. The cylinder is then measured and indexed to a carefully prepared tarage table which relates the crushed lead cylinder (commonly called a "crusher") length to a specific pressure.

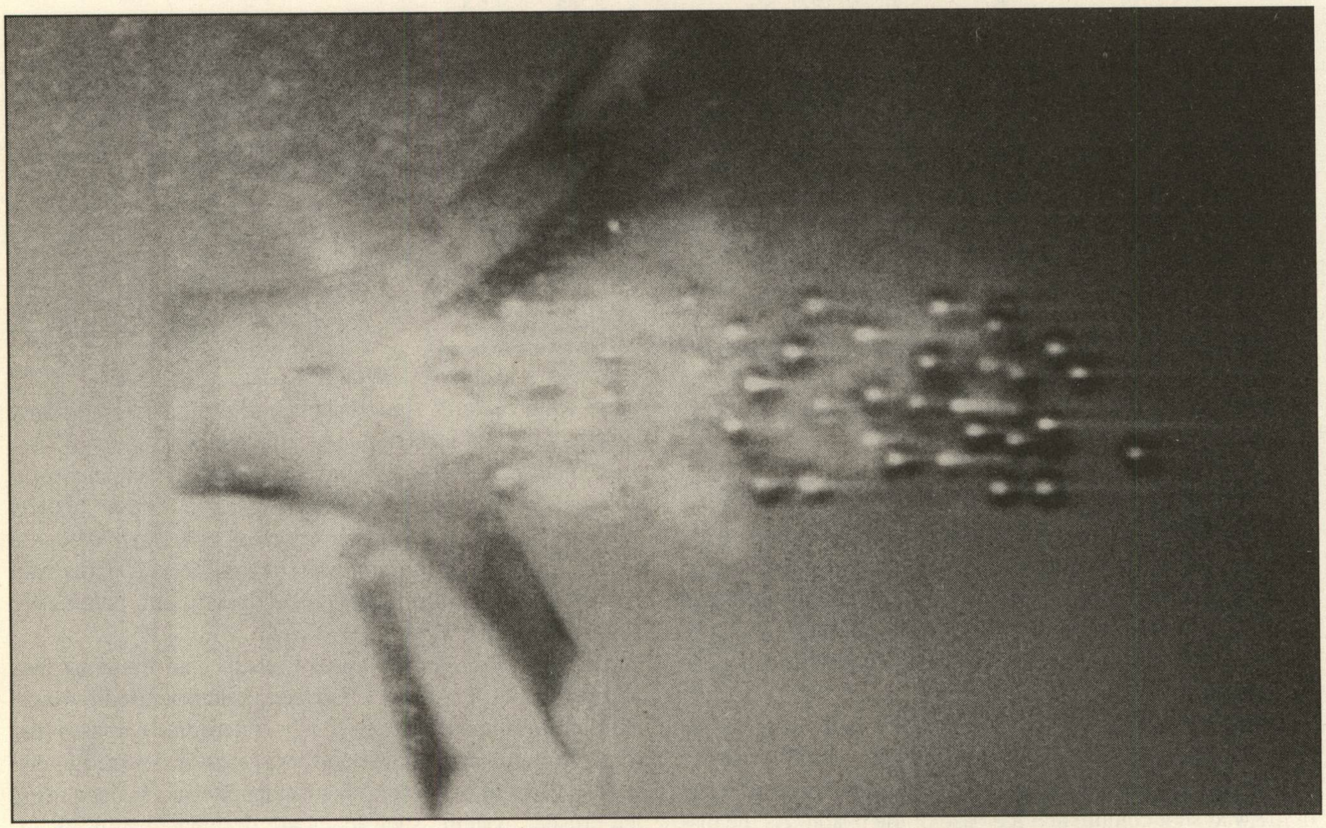
In more recent years, the advancements in computer technology and other electronics has resulted in a more modern, faster-to-use system. A quartz crystal is now mounted to the barrel, converting the compression at the end of its foot (which is exposed to the chamber) directly into pounds per square inch of pressure.

The older lead crusher system is still used by many data producers, but the newer electronic system is used by most ammunition manufacturers. Each system has it pluses and minuses, but eventually the crusher system is destined to disappear. Most of the data in this handbook was obtained using the crusher system. Such loads are designated by LUP for lead units of pressure. Those obtained using electronic testing are marked psi for pounds per square inch.

TABLE V CON'T.

Lead Pellet Time in Flight and Trajectory

Shot Size	MV (fps)	—Time in Flight (seconds)— 20 yds.	40 yds.	60 yds.	Drop (ins.) 20 yds.	40 yds.	60 yds.
#4	1200	.057	.128	.214	0.6	3.2	8.8
#5	1200	.058	.131	.219	0.6	3.3	9.3
#6	1200	.058	.137	.226	0.7	3.4	9.8
#7½	1200	.060	.139	.238	0.7	3.7	10.9
#8	1200	.060	.141	.242	0.7	3.8	11.3
#9	1200	.062	.146	.254	0.7	4.1	12.4
#4	1185	.058	.130	.216	0.6	3.2	9.0
#6	1185	.059	.135	.227	0.7	3.5	10.0
#8	1185	.061	.142	.244	0.7	3.9	11.5
#4	1165	.059	.131	.219	0.7	3.3	9.2
#5	1165	.059	.134	.224	0.7	3.5	9.7
#6	1165	.060	.137	.230	0.7	3.6	10.2
#8	1165	.062	.144	.247	0.7	4.0	11.8
#9	1165	.063	.149	.258	0.8	4.3	12.9
#4	1155	.059	.132	.220	0.7	3.4	9.3
#5	1155	.060	.135	.225	0.7	3.1	9.8
#6	1155	.060	.137	.231	0.7	3.6	10.3
#8	1155	.062	.145	.248	0.8	4.0	11.9
#9	1155	.064	.150	.260	0.8	4.3	13.0
#9	1150	.064	.151	.260	0.8	4.4	13.1
#7½	1145	.062	.144	.245	0.7	4.0	11.6
#8	1145	.063	.146	.250	0.8	4.1	12.0
#4	1135	.060	.134	.223	0.7	3.5	9.6
#5	1135	.061	.137	.228	0.7	3.6	10.0
#6	1135	.061	.139	.234	0.7	3.7	10.6
#7½	1135	.063	.145	.246	0.8	4.0	11.7



The largest pellets at the highest velocity will travel the greatest distance. Safety demands the shooter be familiar with the maximum range of the pellet/velocity combination being shot. This is a charge of #2 pellets as delivered from a Federal 10-gauge Premium load.

TABLE VI

Rifled Slug Ballistics

Gauge	Slug Wt. (oz.)	Muzzle Velocity (fps) Muzzle	50 yds.	75 yds.	100 yds.	Muzzle Energy (fpe) Muzzle	50 yds.	75 yds.	100 yds.
12 3"	1 sabot	1550	1325	1225	1150	2400	1750	1500	1325
12 3"	1 sabot	1300	1100	1025	975	1700	1200	1075	950
12 2 3/4"	1 sabot	1450	1225	1125	1075	2100	1500	1275	1134
12 2 3/4"	1 sabot	1200	1050	975	950	1450	1075	975	900
20 2 3/4"	5/8 sabot	1400	1150	1050	1000	1250	825	725	625
12 3"	1	1750	1300	1150	1050	3000	1675	1275	1050
12 2 3/4"	1	1600	1150	1025	950	2500	1300	1050	875
16 2 3/4"	4/5	1600	1150	1025	950	1950	1025	825	700
20 2 3/4"	3/4	1600	1150	1025	950	1875	975	775	650
20 2 3/4"	5/8	1575	1250	NA	1025	1525	925	NA	650
410 2 1/2"	1/5	1825	1325	1150	1025	650	350	250	200

Rifled Slug Time in Flight and Trajectory

Gauge	Slug Wt. (oz.)	MV (fps)	Time in Flight (seconds) 25 yds.	50 yds.	75 yds.	100 yds.	Drop (ins.) 25 yds.	50 yds.	75 yds.	100 yds.	Midrange Trajectory (ins.) 25 yds.	50 yds.	75 yds.	100 yds.
12	1	1560	.051	.110	.178	.254	.5	2.1	5.3	10.7	.1	.6	1.5	3.1
16	4/5	1600	.051	.110	.178	..254	.5	2.1	5.3	10.6	.1	.6	1.5	3.1
20	5/8	1580	.051	.110	.178	.254	.5	2.1	5.3	9.8	.1	.6	1.5	3.1
410	1/5	1830	.044	.096	.157	.226	.4	1.6	4.1	8.2	.1	.4	1.2	2.5

TABLE VII

Buckshot Ballistics

Gauge	Size	Velocity (fps) Muzzle	10 yds.	20 yds.	30 yds.	40 yds.	Energy (fpe) Muzzle	10 yds.	20 yds.	30 yds.	40 yds.
12	00	1325	1220	1135	1070	1015	210	180	155	135	125
12	00	1250	1160	1085	1030	985	185	160	140	125	115
12	0	1300	1200	1120	1055	1005	185	160	135	120	110
12	1	1250	1135	1050	990	935	140	115	100	90	80
12	4	1325	1195	1095	1020	960	80	65	55	50	45
16	1	1225	1115	1040	975	925	135	110	95	85	75
20	3	1200	1100	1025	970	915	75	65	55	50	45

Buckshot Time in Flight and Trajectory

Gauge	Size	MV (fps)	Time in Flight (seconds) 10 yds.	20 yds.	30 yds.	40 yds.	50 yds.	60 yds.	Drop (ins.) 10 yds.	20 yds.	30 yds.	40 yds.	50 yds.	60 yds.
12	00	1325	.024	.049	.076	.105	.135	.167	0.1	0.4	1.0	2.0	3.2	4.8
12	00	1250	.025	.052	.080	.110	.141	.174	0.1	0.5	1.2	2.2	3.5	5.2
12	0	1300	.024	.050	.078	.107	.137	.169	0.1	0.5	1.1	2.0	3.3	4.9
12	1	1250	.030	.063	.099	.136	.176	.217	0.2	0.7	1.7	3.2	5.2	7.8
12	4	1325	.024	.050	.078	.109	.141	.175	0.1	0.5	1.1	2.1	3.4	5.1
16	1	1225	.031	.064	.100	.138	.178	.220	0.2	0.7	1.8	3.3	5.4	8.0
20	3	1200	.026	.054	.085	.116	.150	.186	0.1	0.5	1.3	2.4	3.9	5.9

Psi and LUP readings cannot be directly compared. When both systems are simultaneously used to measure the pressure of a single shotshell, the psi reading will usually be 1000 units higher than the LUP reading. As average pressures increase, the difference between the two will become even greater.

A Home Ballistics Lab

Many folks would like to exactly check the performance of their loaded ammo. Others may feel a need to develop loads not specifically listed in any data source. In the past, to accomplish such goals, the handloader would have to be very wealthy to afford all of the equipment and facilities needed. This is no longer true.

Until recently, the most the average reloader could do to verify ammunition performance was to own and use a chronograph. This would allow insight into shot-to-shot uniformity as well as average velocity—useful information in judging the worth of any specific load and assembly method.

But measuring velocity performance does not evaluate load safety with respect to chamber pressure. And this has now changed because the handloader can measure the relative safety of his ammo.

Oehler Research has been supplying ballistics testing equipment for more than a few decades. Their list of clients reads like a Who's Who of worldwide commercial and military ammunition manufacturers. They now offer a system of computerized pressure testing suitable for personal firearms at any appropriate range facility. This is the new and rather amazing Oehler Model 43. It will give you more than a dozen data readings, depending on the type of ammo being tested,

TABLE VIII

Horizontal Distance Covered by Shotgun Projectiles

Appropriate Maximum for Buckshot

Shot Size	Distance (yds.) at MV of 1350 fps	Distance (yds.) at MV of 1275 fps	Distance (yds.) at MV of 1200 fps	Distance (yds.) at MV of 1125 fps
00 Buck	610	605	600	590
0 Buck	590	580	575	570
1 Buck	570	560	550	545
2 Buck	530	520	510	505
3 Buck	500	490	485	480
4 Buck	480	475	470	460

Distance is measured from muzzle to first point of impact for shot string.

Appropriate Maximum for Slugs

Gauge	Slug Wt. (grs.)	Distance (yds.)	MV (fps)
12	7/8	820	1600
16	4/5	820	1600
20	5/8	820	1600
410	1/5	845	1830

Distance is measured from muzzle to point of impact for rifles slug.

Approximate Maximum for Pellets

Shot Size	Distance (yds.) at MV of 1350 fps	Distance (yds.) at MV of 1275 fps	Distance (yds.) at MV of 1200 fps	Distance (yds.) at MV of 1125 fps
FF	470	460	455	450
F	450	445	440	430
TT	435	430	420	415
T	420	415	410	400
BBB	405	400	390	385
BB	390	380	375	370
B	370	365	360	355
1	355	350	345	340
2	340	335	330	320
3	325	320	310	305
4	305	300	295	290
5	290	285	280	275
6	275	270	265	260
7	260	255	250	240
7½	250	245	240	235
8	240	235	230	225
9	225	220	254	210

Distance is measured from muzzle to first point of impact for shot string. No allowance is made for balled shot.

Traditional shotshell ballistics testing uses a heavy barrel mounted in a universal receiver set up for the use of lead "crushers."

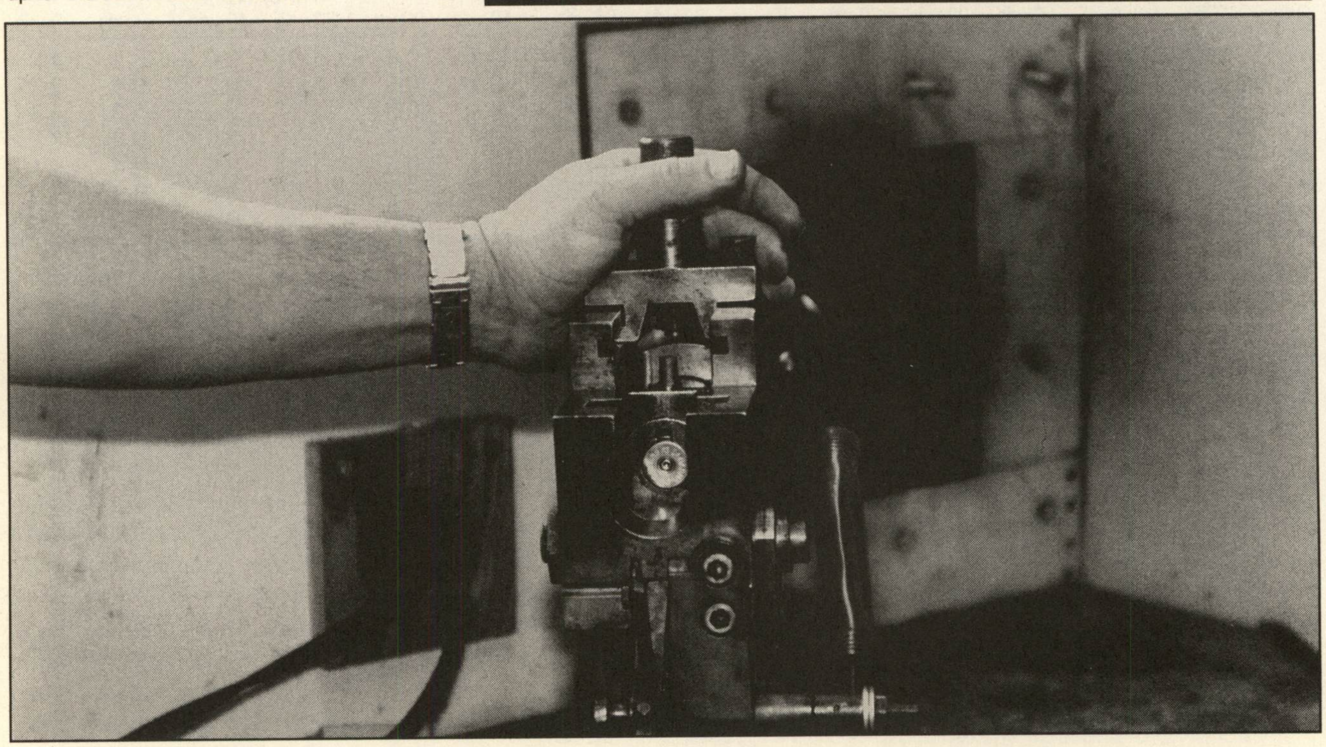


TABLE IX

Tested Slug Performance In Specific Shotguns

Type	Brand	Slug Wt. (oz./grs.)	Velocity (fps) Muzzle	Velocity (fps) 50 yds.	Velocity (fps) 100 yds.	Energy (fpe) Muzzle	Energy (fpe) 50 yds.	Energy (fpe) 100 yds.	Avg. of five 5-shot groups (ins.) at 100 yds.
12-ga. HP	Winchester	1/437	1448	1090	882	2037	1154	756	5 with Rem. 870
12-ga. HP	Remington	1/437	1472	1108	896	2105	1192	780	4.75 with Rem. 870
12-ga. HP	Federal	1/437	1485	1118	904	2142	1214	794	5.25 with Rem. 870
12-ga. HP	Federal	1 1/4/547	1384	1151	931	2327	1609	1050	6.5 with Rem. 870
12-ga. Sabot	BRI (440)	1/437	1234	1098	975	1478	1170	923	5.75 with Rem. 870
12-ga. Sabot	BRI (Police)	1/437	1219	1085	963	1442	1142	903	10 with Rem. 870
12-ga. Pedestal	Worthy	1/437	1425	1097	883	1971	1168	757	7.5 with Rem 870
12-ga. Solid	Brenneke	478 grs.*	1350	1058	864	1935	1188	792	7.5 with Ithaca 37
12-ga. Sabot	Federal	1/437	NA	NA	NA	NA	NA	NA	3 w/rifled Hastings bbl.
20-ga. HP	Winchester	5/8/273	1524	1119	905	1408	759	497	7.5 with Rem 870
20-ga. HP	Remington	5/8/273	1546	1135	918	1449	781	511	7.75 with Rem. 870
20-ga. HP	Federal	5/8/273	1559	1145	926	1474	794	520	8 with Rem. 870
20-ga. Solid	Brenneke	370 grs.*	1386	1086	887	1579	969	646	9.5 with Ithaca 37

12-ga. ballistics obtained in 20-inch slug barrels (Improved Cylinder)
20-ga. ballistics obtained in 26-inch slug barrels (Improved Cylinder)
*All wads are screwed to the base of Brenneke slugs and therefore are part of the projectile weight.

including the pressure of each shot fired. The data that can be had include the following:

1. Assign a round number to each shot fired.
2. Muzzle velocity at muzzle chronograph screens
3. Muzzle velocity validation.
4. Downrange velocity.
5. Peak psi pressure.
6. Show total area under the pressure curve.
7. Time to peak pressure.
8. Display of pressure curve.
9. Display and/or print a complete summary of your test series with average, standard deviation, highest reading, lowest reading and extreme variation for each of items 2 through 8.

The system is not designed to work with semi-automatics which have a recoiling barrel, but almost all gas-operated guns will work just fine. Such information can help the reloader assemble the finest possible loads.

To set up, a thin strain gauge is glued over the chamber area which must protrude beyond the receiver to be used for testing. This system will not work with a barrel that recoils into the inside of the receiver. A few other limitations are encountered in rifle or handgun ammo testing.

Clean the barrel area prior to mounting and glue the gauge to the barrel. Hook up the two wires to the gauge and connect them to the Model 43 "black" box. In turn, connect the black box to your computer, and to all this connect the velocity recording screens.

Once mounted, the tiny strain gauge is not to be removed. Doing so will destroy the gauge, and the finish on the barrel will probably be marred. On some guns, the gauge can be positioned on the bottom of the barrel so it won't be visible when the gun is in normal field use. The Oehler Model 43 system comes with five strain gauges, and additional gauges are about $7 each.

You will need a lap-top computer to run system at this range. If you don't own one, Oehler will optionally supply a lap-top computer of your choice. I strongly recommend a hard drive unit if cost is not an overwhelming factor. I first purchased a non-hard drive unit because it was inexpensive ($450), but

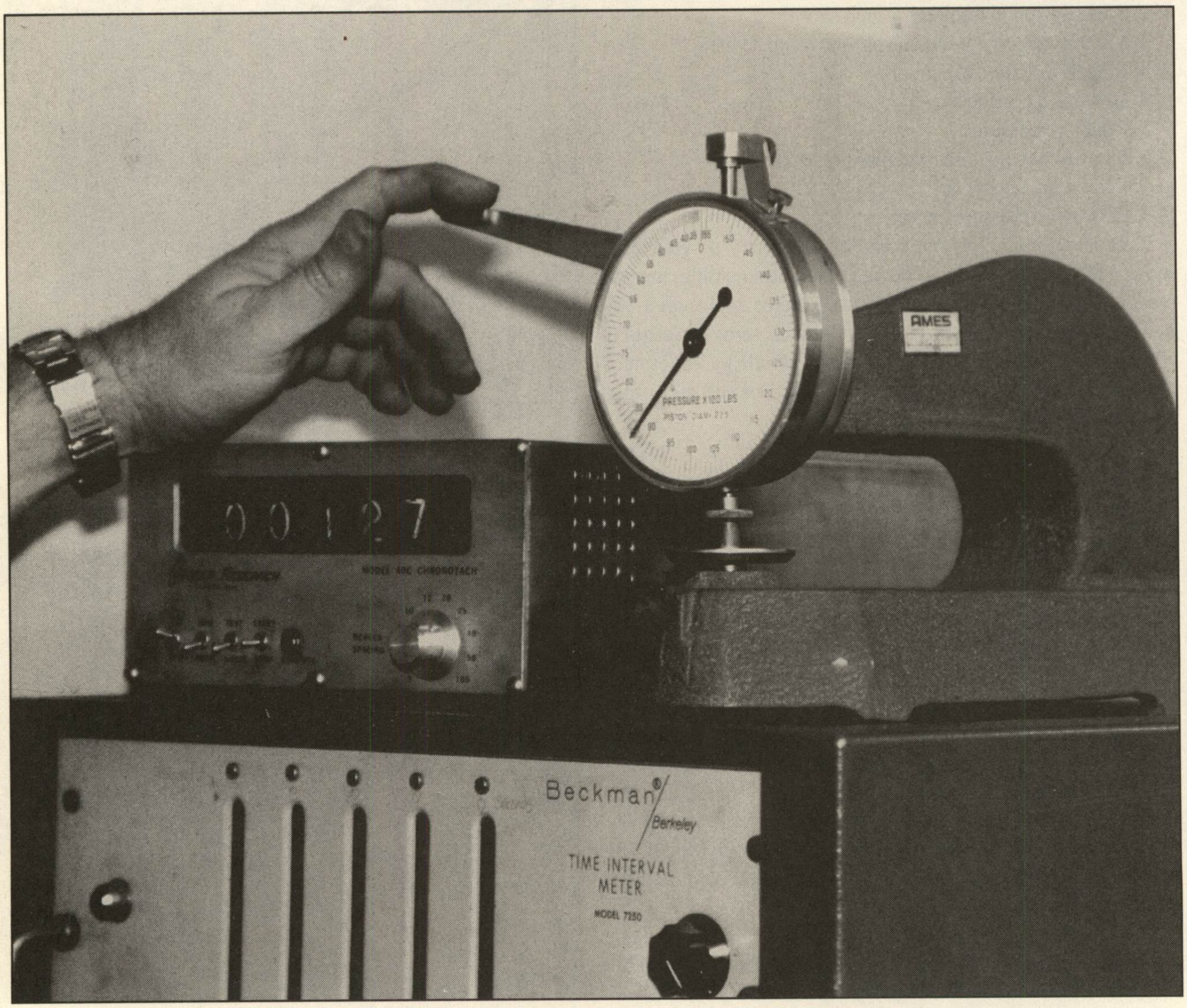
When shooting in the field, the shotgunner generally does not need to be concerned with pellet trajectory.

TABLE X

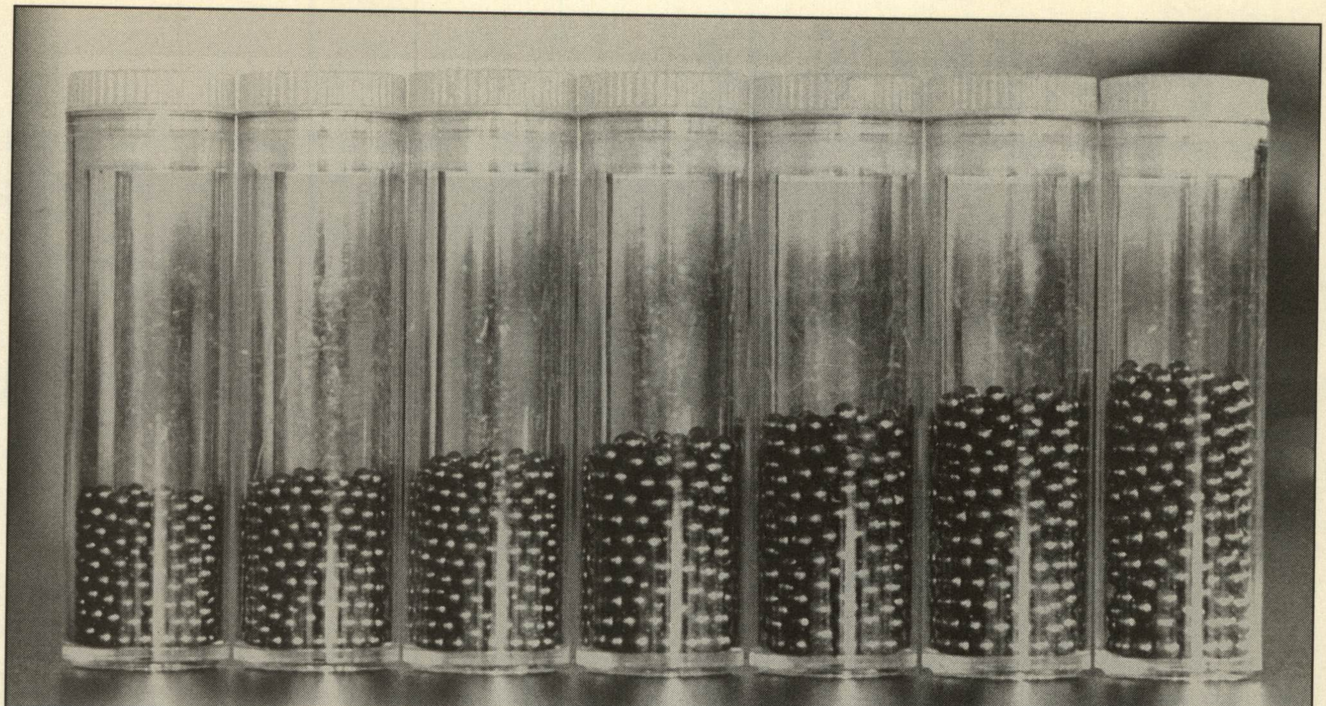
Lead* Pellet Count per Load

Size	#9	#8	#7 1/2	#6	#5	#4	#2	BB
Diameter (in.)	.080	.090	.095	.110	.120	.130	.150	.180
Wt. (grs.)	0.77	1.09	1.28	1.99	2.57	3.37	5.03	8.75
Charge Wt. (oz.)	Pellet Count							
1/2	284	200	170	110	85	65	43	25
11/16	390	275	234	151	116	89	59	34
3/4	426	300	255	165	126	97	65	37
7/8	497	350	298	192	148	113	76	43
1	568	401	341	220	170	130	87	50
1 1/8	639	451	383	247	191	146	97	56
1 1/4	710	501	426	275	212	162	108	62
1 3/8	781	551	468	302	233	178	119	68
1 1/2	853	601	511	330	255	195	130	75
1 5/8	923	651	554	357	276	211	141	81
1 7/8	1065	751	639	412	318	243	163	93
2	1136	802	682	440	340	260	174	100
2 1/4	1278	902	767	495	382	292	195	112

*Assumes 0.5 percent antimony content. Harder shot will be less dense, and hence weigh less, but will have more pellets in a given charge weight. Softer pellets would weigh more and have fewer pellets per given charge weight.



In the lead crusher testing system, the "crusher" length is properly measured with a bench-style gauge rather than a hand-held micrometer.



Users of 12-gauge shotguns can select from a wide range of shot charge weights. Some of these include (from left) 1, $1^1/_8$, $1^1/_4$, $1^3/_8$, $1^1/_2$, $1^5/_8$ and $1^7/_8$ ounces.

I now wish to upgrade. Battery operation is preferable at the range as it eliminates the "noise" present in most AC hookups.

It is not possible in our limited space to cover all the details of this system. Suffice to say, I am truly impressed. The pressure readings I get are similar to those obtained with far more costly commercial lab equipment, both of the LUP crusher and psi electronic types.

It is easy to run if you have some personal computer experience. If not, the manual supplied by Oehler is really complete, including necessary background material in ballistics testing. But expect a learning period if you are really green. At this writing, Oehler even offers relatively low cost workshops to help you with the "ins" and "outs" of pressure testing.

The Model 43 kit has *everything* needed for setup and operation. Cleaners, adhesives, wires, strain gauges, electrical connectors, hand tools and so on—it's all there. What can be learned about ammunition performance with this unit is nearly boundless. Indeed, the careful shooter can progress to doing some of very serious load development.

Pellet Counts

For those who would like to quickly put a pellet count to a specific load, such as when determining actual choking from a specific gun/load combination, Table X will prove useful. Harder shot will have a few more pellets in a specific charge weight, but too few to affect choking values.

The Oehler Model 43 system gathers a lot of information, including pressure and velocity, from a favorite firearm and load.

CHAPTER 15

Hitting With The Shotgun

THE RECIPE FOR hitting with a shotgun involves many ingredients. It starts with proper gun training and the development of good shooting habits. This includes a working knowledge of how to lead a target, which means swinging the gun to where the target will be when the shot finally arrives downrange to intersect its travel. There are many more components involved, too. It isn't possible to pass along all of the tips needed to become a hot-shot gunner in a single book chapter. Indeed, in an earlier effort, I devoted seven chapters of a book to the overall topic. Still, in a book of this type, we would be remiss if we did not cover some of the most important aspects. After all, the proof of the reload's worth is in the hitting.

Shotgunners don't have the luxury of proving a load with the benchrest techniques of rifle and handgun shooters. Nor do they develop the confidence of a big game hunter who often has the luxury of taking carefully aimed shots at (usually) motionless game. Instead, the shotgunner's satisfaction with ammunition comes from the successful bagging of flying or running critters traveling at many different angles and

Hitting with a shotgun is the only way to develop confidence in the assembled ammo. The fundamentals of shotgun shooting proficiency are not difficult to learn.

Recoil control begins with the installation of a soft recoil pad. Pads come in several types: slip-on (top), permanently installed (bottom left), and those that pin onto the clothing (bottom right).

greatly varying speeds. If the shotgunner has not mastered the art of hitting moving targets, then there will be no way to gain real satisfaction from the ammo assembled.

Flinching Destroys Shooting Capabilities

Though it is an often overlooked aspect of shotgunning, recoil is one of the most fundamental problems affecting a shooter's ability to score hits. If there is too much recoil, the shooter will invariably develop a flinch when pulling the trigger. The involuntary action of the flinch is almost never noticeable to shooter or observer, being totally hidden by the recoil of the gun. But, flinching will destroy any hope of becoming any more than a very poor shot.

There is an easy way to test for a flinch. During the course of an informal target shooting session, the shooter's gun should be loaded by someone else, while unseen by the shooter. Sometime during the course of the session, hand the shooter a gun loaded with a dummy shell or simply with nothing in the chamber. If the shooter is flinching, it will be obvious to everyone when the hammer falls. The flinching action may include any or all of the following: closing the eyes, yanking hard on the trigger, pulling the face away from the normal gun-mounted position, pulling the shotgun in an unnatural direction, hunching of the shoulder, and so on.

Though detecting a flinch is easily accomplished, the specific reasons for it may not be as easily detected. However, either recoil and/or noise are almost always the cause. Sometimes, a poorly fitting gun may be the reason that recoil becomes a problem.

Recoil

Recoil is understood in two ways—perceived recoil and free recoil. Perceived recoil is what we feel as a result of many variables. For example, two shotguns of identical weight, firing identical ammo through identical barrel lengths, will produce identical true or free recoil, which is basic physics concerning the conservation of momentum. Going past all of the technical stuff, for every mass of ejecta pushed out of the front end of a barrel at a specific velocity, there is an opposite and equal reaction—recoil.

Recoil, for a given set of ballistics (the total weight of the ejecta, which includes powder, wad and shot; the ejecta's muzzle velocity; the velocity of escaping gases at the muzzle; and combined with a given gun weight), is constant. But perceived recoil, that which we feel, may be altered by a number of factors. For example, if two guns of identical weight differ only by having a hard buttplate on one and a soft recoil pad on another, the one with the soft pad will seem to kick less. The recoil pad must fully collapse before all of the recoil is felt. Thus, the pad effectively increases the time period over which

The ammo placed into the chamber will determine the degree of comfort, or discomfort, that the shooter will experience. Free recoil in a 12-gauge gun can range from a comfortable 14 fpe (1-ounce light target loads) to a bone-jarring 51 fpe ($1^7/_8$-ounce 3-inch magnum loads). The latter has recoil equal to firing 3.6 of the target loads. Fatigue caused by recoil with such loads can quickly exceed a shooter's capability and induce involuntary flinching.

the recoil is distributed to the shooter's shoulder.

This is similar to having a sharp blow of a fixed force suddenly applied to your jaw (as in a punch), as opposed to the same total energy being applied over a longer period of time (as in a heavy push).

The same thing happens when the gun is not held firmly against the shoulder. A loosely held gun gets a running start to deliver its force as a punch, whereas a firmly held gun only gets to push—comparatively speaking.

Other factors can alter perceived recoil. For example, a stock too short (or too long) will cause more discomfort to the shooter than a stock that fits properly, because the butt and comb contact with the shoulder and face will not minimize the felt recoil. If the butt rests against the upper arm, instead of the shoulder, there will be a lot of additional discomfort, even real pain. Some parts of the anatomy simply are more sensitive to abuse than others.

The amount of drop on a stock can also change perceived recoil. Generally, the straighter the stock, the less the recoil is perceived. A straight stock helps direct recoil momentum straight to the rear against the shooter's shoulder. A stock with excessive drop will allow too much muzzle climb and will punch the comb of the stock against the shooter's face.

Perceived recoil can also be altered with a muzzlebrake or by porting, reducing the amount of muzzle jump and/or redirecting the escaping gases from a straight-ahead orientation.

Shooters And Recoil

There is no doubt that the effects of recoil are cumulative. For example, each shooter has a personal level of recoil tolerance per shot as well as the total accumulated during a given shooting session. While one shooter may be able to handle a few rounds of 12-gauge $3^1/_2$-inch ammo without flinching, firing one hundred rounds of 12-gauge $2^3/_4$-inch target loads may cause an involuntary flinch at some point.

There is nothing macho about the controlled handling of lots of recoil. I have seen rather robust men who found a 20-gauge target load objectionable, and some of them would rather make great claims for small gauge effectiveness than deal with the recoil problem. Also, I have known a few women of slight stature that could shoot several boxes of 12-gauge, 3-inch, 2-ounce loads and never give recoil a second thought.

Controlling Recoil

To develop good shooting habits, a shooter must learn to manage recoil. For example, a soft recoil pad can make a noticeable difference in performance. I stress *soft* because

When participating in sustained shooting such as Sporting Clays, trap or Skeet, it pays to use as light a load as can get the job done. Such loads might range from 1 ounce of shot at 1145 fps to $1^1/_8$ ounces of shot at 1200 fps.

some of the red rubber, hard-as-a-brick pads installed on guns by certain manufacturers result in no significant change in perceived recoil. From a practical standpoint, these pads are totally ineffective.

Some ammo makers claim specific loads will give less recoil than others with identical muzzle ballistics. This, they claim, is true because they use a slower burning powder. From a practical standpoint, this is nonsense. Tests have been run from time to time for more than fifty years to prove or disprove this theory. Each time, it was shown that shooters cannot differentiate between a few micro-seconds of in-barrel time.

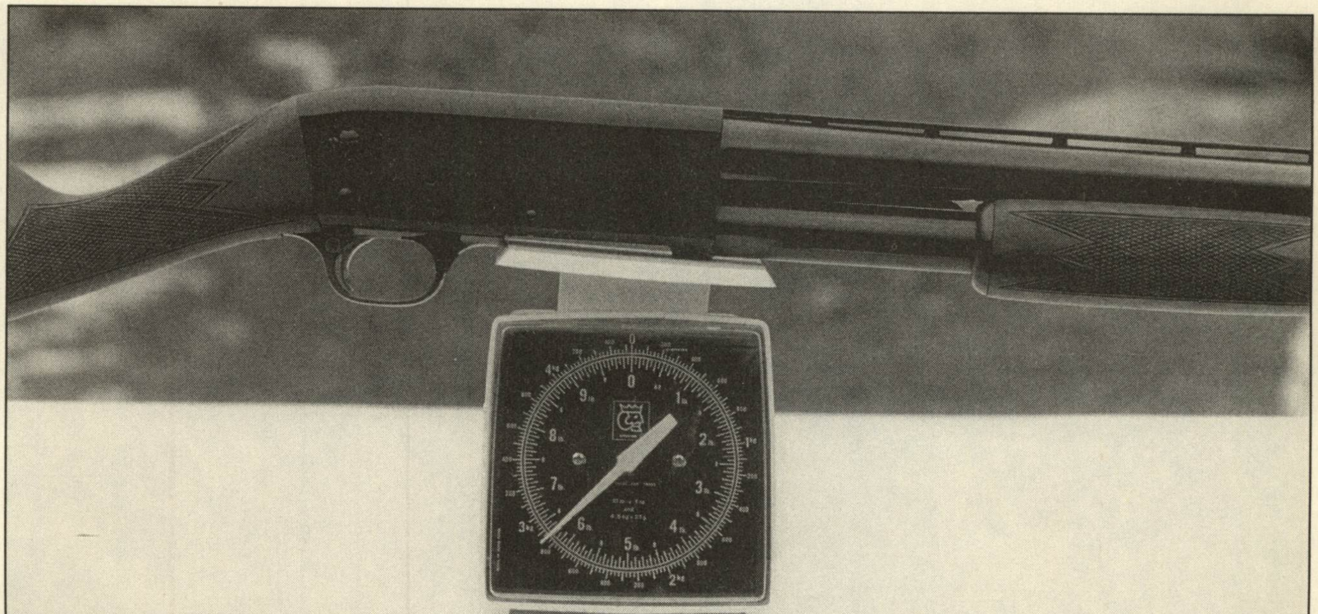
The powder burn time, as well as the in-barrel time, of shotshell loads using any speed of powder is very brief. There are few (if any) shooters who can perceive a difference in 1, 2, or even 3 micro-seconds of burn time and the perceived recoil. Further, when slower burning powders are used, there must be a heavier powder charge to keep muzzle ballistics identical. When the effect of the additional weight of the powder on total recoil is calculated, such a load actually has more free recoil than a load using a lighter charge of a faster powder. So, any advantage in spreading out recoil for an additional few micro-seconds is offset by the increase in actual recoil.

There also can be no *practical* control of recoil by changing the internal dimensions of chambers, forcing cones or bores, and chokes. So long as muzzle ballistics, gun weight and gun fit remain constant, so will recoil. Internal barrel dimension changes will affect ballistics, though. If a very long chamber and forcing cone and/or an increase in bore diameter result in a decrease of average muzzle velocity, of say 35 fps, then there will be a corresponding decrease in free and perceived recoil.

Practical Methods For Controlling Recoil

As mentioned earlier, the use of a soft recoil pad can make most shooters comfortable with guns and ammo that are not too far from their tolerance level. But, no recoil pad will turn a 12-gauge $3^1/_2$-inch hunting load into a tolerable target load. Other methods need to be tried.

Porting (having slots carefully cut into the muzzle to alter the direction of escaping gases) can reduce muzzle jump and



Shotgun weight noticeably affects free recoil. Very light guns such as this $6^1/_4$-pound one will deal out plenty of recoil—approximately 20 percent more than a $7^1/_2$-pound gun.

perceived recoil. But the catch here is increased noise. Before porting, make sure it is recoil and not noise bothering the shooter. Using a good set of ear protection can help in this determination. If flinching disappears, then noise and not recoil is the culprit. In my opinion, most shooters are more sensitive to recoil than noise, but there surely are exceptions.

Gun weight is another factor affecting recoil. In theory, if the weight of the gun is doubled, the amount of recoil will be halved. Inversely, if the weight of the gun is halved, the recoil will be doubled. But this approach must be balanced with practical shooting needs—all-day carrying and/or the repeated mounting and swinging action in competitive target shooting. About 8 pounds is plenty heavy for most shooters; $8^1/_2$ pounds seems to be the practical maximum, even for those with a lot of stamina. Guns less than 7 pounds often can be a handicap—both for recoil and proper gun swing/follow-through.

Semi-automatic guns reduce felt recoil. The momentum of recoil is spread over the action cycling time. This notable increase in time effectively reduces perceived recoil, though total free recoil remains the same. Shooters can often fire twice as many shells with a semi-automatic compared to an otherwise identical weight fixed-breech gun.

So, a ported semi-automatic with proper stock dimensions, a soft recoil pad, and of moderate weight is the best that can be done to reduce the effects of recoil without altering ballistics. There are devices which can be mounted in or on the gun that are claimed to reduce recoil. At least some of these are no more effective than adding of a lead weight of identical mass.

Ballistics and Recoil

Selecting ammo of lesser ballistics can be effective in controlling recoil. The higher the velocity, all else equal, the greater the recoil. The same is true for shot weight. The heavier shot loads kick harder, again all else equal. Table I gives examples of the various recoil levels of many popular loads, when the gun weight is constant. To make an approximation of recoil with guns of different weights, first calculate the percentage of the new gun weight compared to the table's weight of 7.5 pounds. For example, a 7-pound gun will have 1.07 times the recoil (7.5 divided by 7 equals 1.07). Therefore, multiply the listed recoil by 1.07. An 8-pound gun will have 94 percent of the recoil of the 7.5-pound gun (7.5 divided by 8 equals 0.9375). Therefore, multiply the listed table recoil by 0.94 to obtain the free recoil of an 8-pound gun.

The resulting numbers may not be exact, but give relative comparisons close enough to judge the degree of perceived recoil. Table II gives weight conversion factors to adjust recoil figures from Table I, quickly showing that a 5-pound gun has

Practice and practice some more to develop a tolerance to recoil. Then you can easily switch to heavier field loads when hunting without developing a flinch. But do not use loads so heavy that you can actually notice the recoil in the field.

150% of the recoil, or a 10-pound gun 75% of the recoil, as compared to the 7.5 pound example.

Remember, gun weight is important. You cannot hand a beginner a very light single shot 20-gauge gun and expect that recoil will necessarily be lighter than your heavier 12-gauge using target loads.

In an $8^1/_2$-pound 12-gauge gun, a $1^1/_8$-ounce, 1145 fps, target load with average powder and wad weight would have a recoil level of 15.3 fpe. A 20-gauge $6^1/_2$-pound gun with an average $^7/_8$-ounce target load of 1210 fps would have a recoil level of 13.7 fpe. This is only a 1.6 fpe difference, or about what it takes for most shooters to notice a difference (a 10-percent change in recoil can be felt by most shooters). Reduce the weight of the 20-gauge gun to $5^1/_2$ pounds, and this target load will actually have more recoil than the 12-gauge load in the $8^1/_2$-pound gun. Picking a smaller gauge will obviously not control recoil if the weight of the gun gets so light as to negate potential gains.

TABLE I

Recoil Comparisons Of Popular Loads

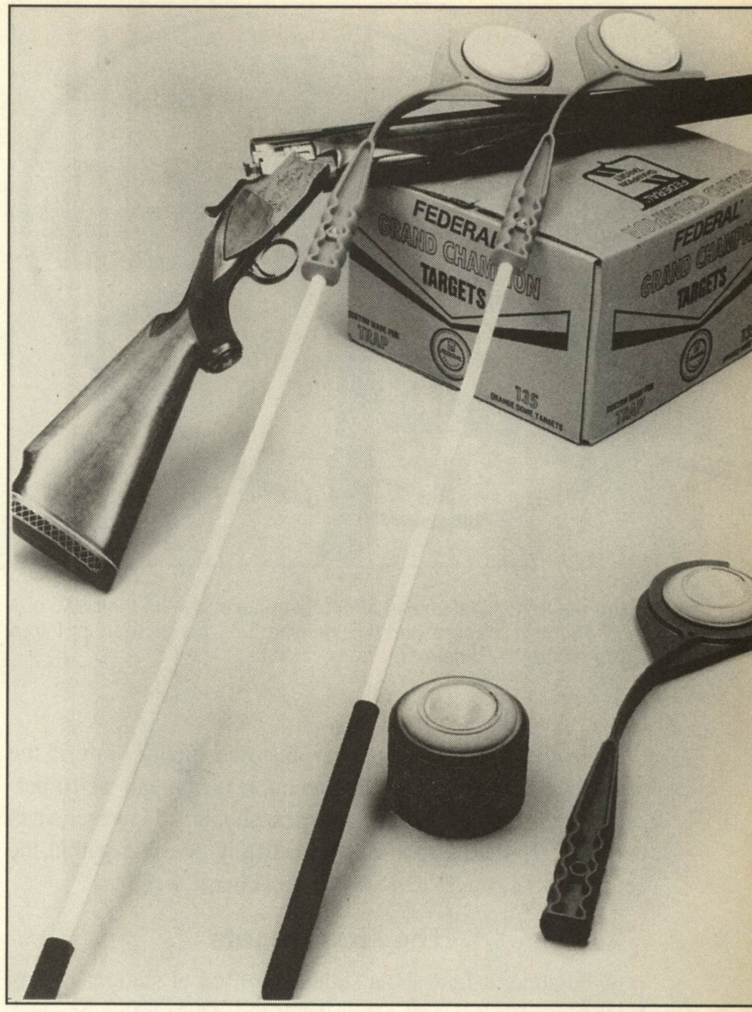
Shot Charge Wt. (oz.)	MV (fps)	Free Recoil (fpe)
$1^7/_8$	1210	50.9
$1^5/_8$	1280	44.3
$1^1/_2$	1260	36.7
$1^3/_8$	1295	33.9
$1^1/_4$	1330	29.7
$1^1/_4$	1260	26.0
$1^1/_4$	1220	24.0
$1^1/_4$	1185	22.1
$1^1/_8$	1330	24.5
$1^1/_8$	1295	22.7
$1^1/_8$	1255	21.4
$1^1/_8$	1200	19.2
$1^1/_8$	1185	18.8
$1^1/_8$	1145	17.4
1	1290	18.2
1	1220	15.6
1	1165	14.1
$^7/_8$	1210	11.9
$^3/_4$	1295	10.5
$^{11}/_{16}$	1135	5.6
$^1/_2$	1135	3.5

Data is based on a shotgun weight of $7^1/_2$ pounds.

Learning To Handle Recoil

A shooter should always begin practice sessions with a load that is well below comfort level. Remember, the effects of recoil are cumulative. Fire enough shots and the body begins to flinch. Carefully balance the number of rounds to be fired and the recoil level of the load. The trick is to stop shooting *before* recoil fatigue takes its toll.

Most people with extensive shotgun hunting experience find a recoil level of about 19 fpe is near maximum for prolonged shooting. Generally, beginners need to stay below 14 fpe and not fire more than about twenty-five rounds in the first sessions. Then, gradually build up to about 100 rounds a day before thinking about increasing recoil on a per shot basis.

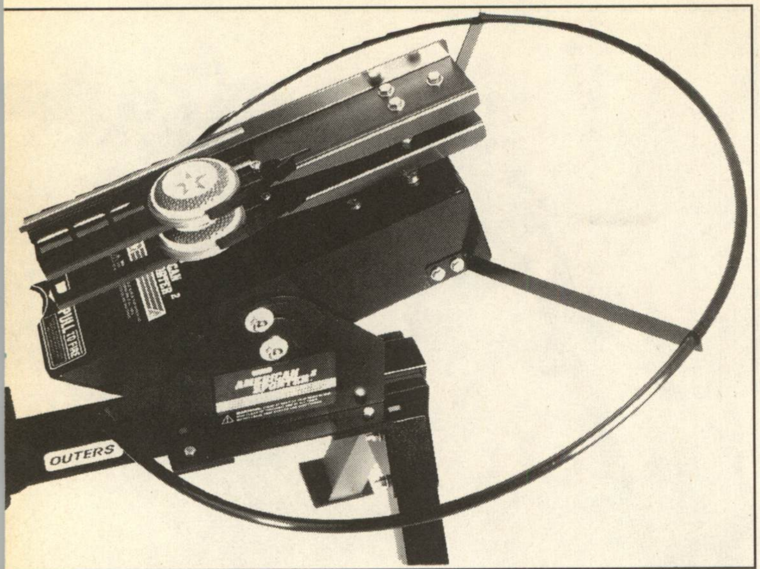


After shooting a few stationary targets, initial practice can be accomplished with some clay targets and a hand "trap."

TABLE II

Weight Conversion To Adjust Recoil Values in Table I

Gun Weight (lbs.)	Multiplying Factor
5.00	1.50
5.25	1.43
5.50	1.36
5.75	1.30
6.00	1.25
6.25	1.20
6.50	1.15
6.75	1.11
7.00	1.07
7.25	1.04
7.50	1.00
7.75	0.97
8.00	0.94
8.25	0.91
8.50	0.88
8.75	0.86
9.00	0.83
9.25	0.81
9.50	0.79
9.75	0.77
10.00	0.75



Elaborate traps, available at affordable prices, can be the basis of a lot of shooting practice and fun, helping turn the shotgunner into a highly proficient marksman.

Even the heaviest recoil can become manageable if the build-up is gradual. Increasing recoil in increments of 10 percent at a time seems to work for most shooters. However, such uniform steps are not always ballistically possible within the constraints of gauges and normal shot charge weights.

The First Targets

A beginner's first shots should be fired at stationary clay birds placed in front of a safe backstop. During this practice, the shooter can be taught proper stance and gun mounting. Additionally, hand-held clay target launchers can help. However, this practice should be confined to shooting birds thrown straight away from the shooter. The difficulty in maintaining constant bird speed with hand-thrown targets can make teaching leads very difficult, though. Later, if there is no Skeet range available, mechanical launchers, such as an Outers Sporting Clays Trap, can be a useful aid in teaching shooters how to hit targets flying at various angles.

Learning To Hit Moving Targets

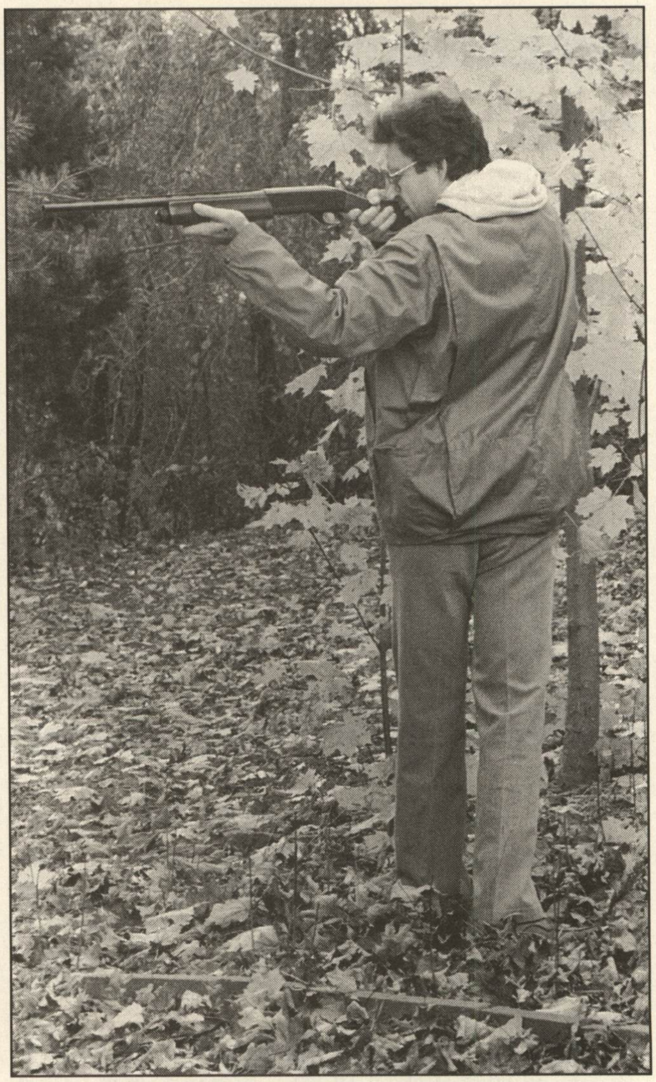
Perhaps the best way to learn to hit moving targets is the game of Skeet. The principles applied in Skeet shooting are applicable to all shotgun shooting. Unlike trap or Sporting Clays, Skeet offers the comfort of knowing beforehand what the flight of the clay target will be, and the target has a constant primary velocity regardless of the station. The shooter learns precisely how much lead is required to break each target. The eight different Skeet stations offer numerous shooter-to-target angle variations: birds going straight away, traveling at 90 degrees, and coming directly at the shooter. In addition, many in-between angles of shooting are covered.

When shooting Skeet, some basics should be committed to memory, including proper stance, proper gun mounting, target acquisition, swing-through, lead, and follow-through. Without these, no one can become an accomplished shotgunner. Naturally, all normal safety and gun handling manners must be learned as well.

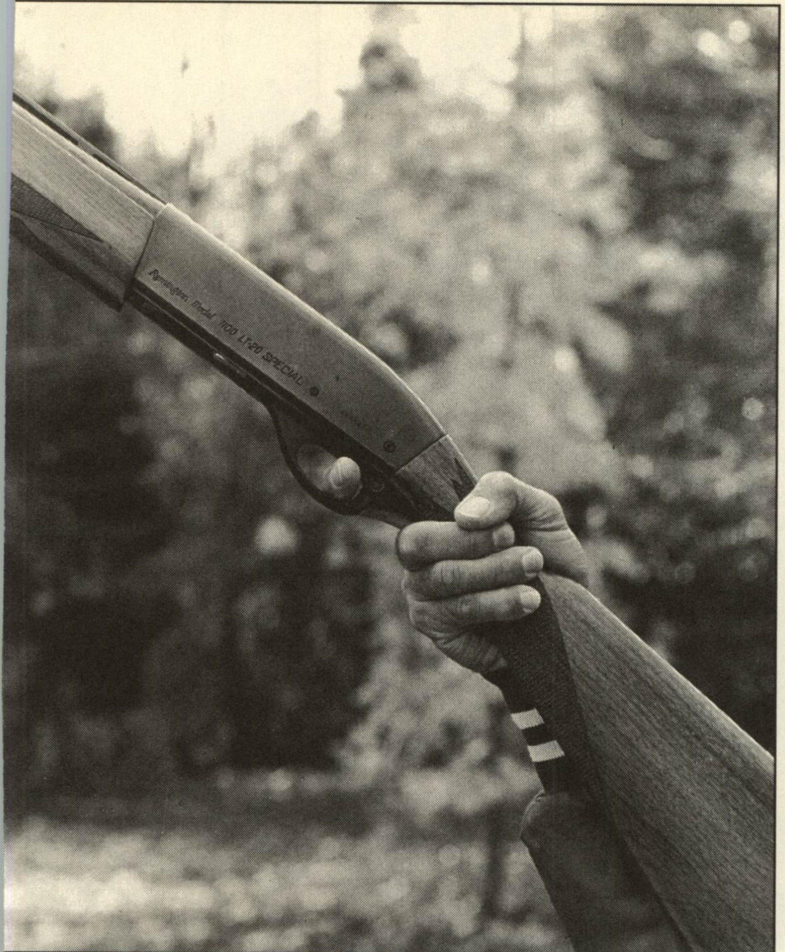
Stance

These instructions for stance and gun mounting are for right-handed shooters. Reverse the descriptions if you are a lefty.

Foot position is critical to good shooting form. Even in the field, the best shooters will take a step, if necessary, before beginning to mount the gun. The left foot should be pointing where the target will be broken, not where the gun will be started nor at the target's present position. The left foot is *always* positioned from a half to full step forward of the right foot. The actual distance is simply a matter of comfort and balance. For a novice, a half-step is usually best. The left knee should be bent slightly, as this greatly assists the swing, although swinging is done from the waist only.



This shooter is likely to accomplish nothing but misses. Note that his feet are pointed in a less than useful direction. A good shooting stance demands the left foot of a right-handed shooter be pointing generally at the place where the shot charge will intersect the target.



Proper gun handling and/or fit is not present here. Note the trigger finger is positioned so the trigger will be pulled by the center section of the finger rather than the ball of the first joint.

Here is how the trigger finger should be positioned. The ball of the fingertip should rest on the trigger. No other trigger finger contact with the shotgun should occur. Repositioning of the hand grip on the shotgun can sometimes make for a proper finger placement on the trigger. Other times the stock may have to be made longer or shorter for a correct fit.

The right foot should be at a slight angle, pointing about 45 degrees away from the left foot. This, too, is a matter of comfort, so use it as a starting point. But pointing less than 20 or more than 60 degrees will invariably lead to poor shooting habits. A trace of bend in the right knee will be necessary, depending upon the amount of bend in the left knee.

This basic stance should always be assumed before gun mounting. Always use the same stance for every shot, as body position and gun mount position are essential to consistent hitting.

Gun Mounting

Precise gun mounting is essential because the positioning on your shoulder can cause the pattern to go high, low, left or right. If the gun is not mounted the same for each shot, it will be hard to correct misses.

To properly mount a shotgun, the forend should be grasped a comfortable distance from the action. When mounted, the left elbow and forearm should be about 45 degrees from vertical, or a bit less. This aids follow-through.

The right hand, grasping the wrist area of the stock, should be placed so the ball of the trigger finger rests comfortably on the trigger. There should be no contact by the trigger finger with either the stock or any other action part.

Now lift the gun up to a few inches off the shoulder with the muzzle pointing about 30 degrees above the horizon. Bring the gun tightly to the shoulder and place the cheek *firmly* against the stock. *Never*, not ever, should the cheek be removed form this position. If the gun must be swung up or down, left or right, the cheek should be glued to the stock. Indeed, on upward or right swings, the stock should actually push the cheek and head. On down or left swings, the shooter must work hard to keep solid face contact. Picking the head up for a "better" look is the primary reason for many misses, even when experts are involved. On the Skeet field, lifting the head is one of the most common reasons for missing either target from station eight. Simply put, the gun won't be looking where you are if your head is not down tight.

When mounting a shotgun, do not stretch the neck in any way. I tell my students to simply bring the gun up as described

A properly mounted shotgun will rest squarely on the hollow of the shoulder (never on the forearm), and the face of the shooter will be in firm contact with the stock comb at all times. Also the shooter's forearm will be positioned at an appropriate angle.

and bend the head forward with no more neck movement than is natural to accomplish the goal.

When the gun is at the shoulder, the right elbow and forearm should be somewhat below horizontal. Some might be more comfortable with the forearm on the same plane as the horizon. Dropping the elbow too far will lessen the control of swing and follow-through.

Generally, the butt of the gun should be completely on the cup of the shoulder, never on the upper arm. Any difficulty assuming this position often can be traced to poor gun fit or improper feet and leg positions.

Starting Point For Muzzle

When the gun is mounted, where is it pointed? It should be directly in the bird's path at a spot directly over the stake in the center of the Skeet field. Then the body is pivoted at the waist to bring the muzzle to the starting point some 15 feet out of the trap window.

Sight Picture

Do I have the gun mounted properly? The answer to this is in the sight picture. Therefore, it is easier to learn to shoot if the barrel has both a front and middle bead.

However, the beads are never used to aim at the target. They are there only to ensure proper mounting. An experienced shooter can get along just fine with no beads on the barrel. But that is for the folks who don't need to read this chapter.

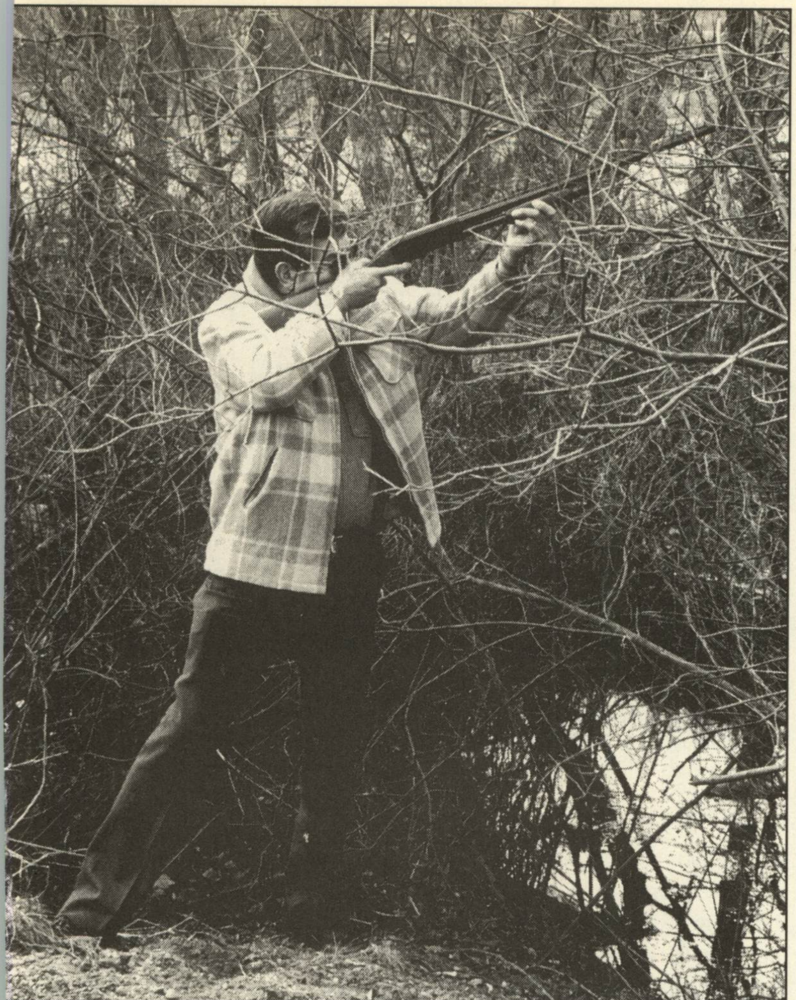
The sight picture you should see has the middle bead sitting just below and actually "touching" the bottom edge of the front bead. The two beads should, in effect, form a figure eight.

If this is not the case, the gun must be mounted differently—higher or lower on the shoulder cup. Mounting should be practiced repeatedly, long before actual shooting begins, to make sure the beads are always properly aligned.

Finally, remember to lean into the gun slightly, never away from it.

Become A Gun Turret

Once the gun is properly mounted, the relationship of the head on the stock, the grip of both hands and the position of both arms should become locked into place. From this point,



The position of the feet are vital to effective shotgunning. Even in heavy cover and less than level terrain, it is important to get the left foot out front and pointing to where the quarry will be shot.

all movement is accomplished by bending and swinging the upper torso at the waist and only the waist. You need to be like a tank. From the waist down, you're a tank's chassis; from the waist up, you're the gun turret. All swinging is done at the joint of turret and chassis. Unlike the tank, you will also raise or lower the muzzle by bending at the waist.

Yes, there can be exceptions, but for the beginner this approach is best, and it invariably results in hits 75 percent of the time.

Target Acquisition

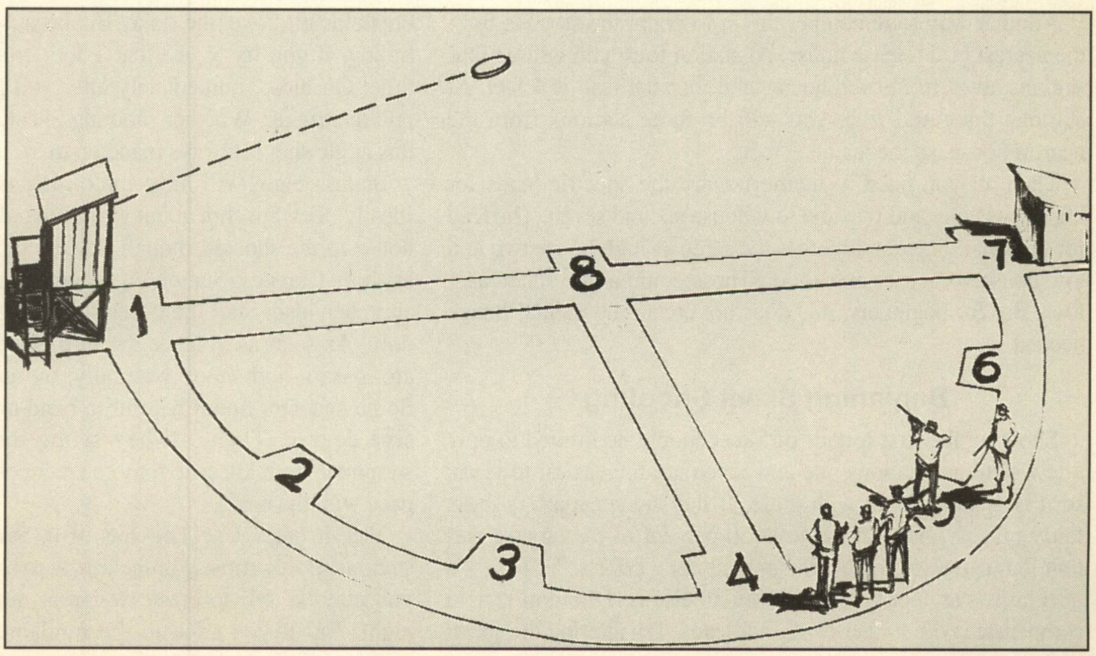
On the Skeet field, the shotgun will always be pointed at the same starting place before calling for the bird. The left foot should be pointing directly at the stake in the middle of the field, then follow the rest of the previously described stance and gun mounting. At this point, swing from the waist, bending a bit as required, to bring the barrel to a point in front of the trap house. The starting distance from the window is always the same for every station—about 15 feet. If you have difficulty "seeing" the same 15 feet from the various stations, don't worry. It is a point on the bird's path that intersects an imaginary line drawn straight from station two for the high house, or from station six for the low house.

Remember, once the gun is properly mounted, forget the sight beads and think only of the relationship of the muzzle to the target.

Swing, Lead, And Follow-Through

While the gun is held motionless, call loudly for the bird and *don't move the gun muzzle* until the bird passes it. Avoid the tendency to begin swinging at the sound of the bird being released. Then, pass through just an inch or so under the bird, tracking it on the same flight path. As you swing through, gain the required lead and pull the trigger, *but don't stop your swing.* If you stop, the shot pattern will pass behind the bird; you must maintain the swing to score a hit. Many of my stu-

The layout of a Skeet field is illustrated. Shooting progresses counter-clockwise starting at station one and ending at eight.



dents find it best to continue the swing artificially all the way across the field.

Skeet Leads

The shooter who wants to learn Skeet should memorize the necessary leads for each shot at each station. There are both high house and low house birds released at every station. These targets (singles) are shot one at a time. In addition, there are two birds (doubles) released simultaneously at stations one, two, six and seven. The field is arranged like the lower half of a clock. The high house is positioned at 9 o'clock, the low house at 3 o'clock. There are shooting stations at 9, 8, 7, 6, 5, 4 and 3 o'clock. Additionally, there is one station in the middle of the field which would be at the pivot point of a clock's hands.

TABLE III

Skeet Leads

Station	High-House Lead	Low-House Lead
1	6 inches low	1 foot
2	Pass and shoot	2 feet
3	3 feet	3 feet
4	4 feet	4 feet
5	3 feet	3 feet
6	2 feet	Pass and shoot
7	1 foot	Hold on bird
8	Pass and shoot	Pass and shoot

The leads in Table III may vary slightly, depending on the individual's speed of swing. Don't be concerned with altering leads until you are an accomplished shooter and know without a doubt that you use a very fast or slow swing and follow-through.

These Skeet leads are easy to remember. For the first half of the field, with but two exceptions, use a lead in feet equal to the station number, i.e. station three—3 feet, station four—4 feet. After station four, simply back down a foot of lead at each succeeding station, i.e. station five—3 feet.

Another way to remember this is to count the stations from the nearest bird release house. At station four, you will be four stations away from each house, and thus the lead is 4 feet. At stations three and five, you will be three stations from the nearest house, so the lead is 3 feet.

Then all you need to memorize are the specific leads for high house one and two and low house six and seven. The lead for both station eight targets is the same as high house two and low house six—pass and shoot. These could all be stated as 1 foot. But for beginners, this does not create the mental image needed.

Beginning Skeet Shooting

Shooting the first rounds of Skeet should be limited to only a few stations. Stations one and seven are the easiest to learn, so it is wise to begin with these. If the shooter masters these fairly quickly, breaking at least 50 percent of the targets, station four can also be included in beginning efforts.

If targets are not breaking when all else is right, don't try to compensate with longer or shorter leads. Try altering the speed of the swing. Your timing is about perfect when the birds are broken directly over the stake in the middle of the field. If birds are breaking too soon or too late, the recommended leads are then incorrect. Learn to correct with the speed of swing, and you will avoid a lot of poor shooting habits.

In the field, most shots can be equated to a previously practiced Skeet shot. This pheasant is flying a course nearly identical to a Skeet station one high house shot.

Some stations will force some obvious changes. For example, to lead the station seven low house bird, simply shoot right at it. It is moving directly away, and to point in front of it you must point through it.

Other exceptions are station two high house and station six low house. The actual lead required on these shots is 1 foot to break the bird over the stake. But because of shooter angle and timing, if you try to see that 1 foot, you will fail to shoot in time. On these, immediately after you pass through the bird, pull the trigger. Whether shooting Skeet or hunting in the field, this angle shot is always made on trust.

Station eight will have the birds passing over your head. Ideally, they are shot about two-thirds of the distance from the house to the shooter, though novices often break these targets at shorter ranges. Station eight targets use the pass and shoot approach also. Start the gun just below the release house window. As soon as you see the bird, swing upward through its arc, pass it and shoot. Naturally, the gun is always moving. Some shooters find it helpful to bend both knees to an excessive degree. Then, as they swing through the bird, they straighten both knees to a more erect position. This helps keep pace with the bird.

Yes, it takes practice—lots of it. Start with only the easy stations. By the time you feel ready to shoot the whole course, you may be able to break twelve or more birds, or as few as eight. But if you stick to the fundamentals, and solicit the advice of a good coach, scoring well on birds is not really very difficult. Just keep in mind that not all good shooters make good coaches. If it doesn't come together, try another coach who works well with predetermined leads and a fixed starting point for the gun. The fixed leads and starting point give the novice an easy way to troubleshoot problems. Other methods may work, but can be exasperating to a novice.

Hitting In The Field

Scoring hits in the game field should be an extension of lessons learned on the Skeet field. The shooter addresses each shot the same way. Those coming directly at the shooter, going directly away, as well as birds traveling at 90 degrees were all part of the learning process. Many, if not most, field shots are similar to a station one low house or a station four high house and so on.

While it won't be possible to have the shotgun mounted and pointed at a spot in the target's trajectory, all else will be quite similar. Point your left foot at the place you will hit the bird. As you mount the gun, the bird will be moving and the gun will be pointing somewhat behind it. At this point, everything now becomes nearly identical to the Skeet field. Swing past to the correct lead, fire and complete the follow-through.

Naturally, in the field, some game will be traveling faster or slower than clay targets. Here, intuition takes over. Very fast critters will force you to swing faster to get ahead of them. This will be an instinctive self-correction, even though you are using standard Skeet leads. On slow moving game, if you pass the bird very quickly, you subconsciously fire immediately in front—just like a station two high house bird. Some refinements will be needed for specific shots, of course, but if you are practiced at Skeet, adjustments are easily made.

This field shot is identical to a Skeet number four station low house shot and should be hit now or ideally a few feet earlier in its path.

Field success means a great deal of clay bird practice and plenty of first-hand experience. But, rewarding moments such as this are not overly difficult to achieve.

The Clock Start

There is another method of field shooting that can help speed up the learning process. The shooter pictures a gigantic clock in front of him. Directly ahead, and about 30 degrees above the horizon, is the center of the clock—where hands would pivot. This is always the starting point for the mounted gun.

The feet are pointed at the center of the clock or where the game will be when hit, or some point in between. Since the shot must be taken very quickly, it eliminates excessive foot positioning time. Because the feet may not be ideally positioned, the shooter must be very accomplished in swinging at the waist.

When using this method, a bird flying straight away and level will actually be dropping below the center of the clock. A correct lead swings the muzzle down through the bird and in front of it (a station one high house). Other leads will be obvious if the gun is properly started at the imaginary clock center. This method can also be used by shooters who don't have an opportunity to learn Skeet. However, the correct leads will then be learned by trial and error—a difficult way to start.

Sporting Clays is a game designed to simulate field shooting as closely as possible. For this reason, some shooters find it a difficult beginning place. Nonetheless, with a good coach and the target throwers set for the easiest possible birds, a level of proficiency can be learned and built upon. However, the shooter who first learns Skeet will best handle a Sporting Clays field.

CHAPTER 16

Keeping Records

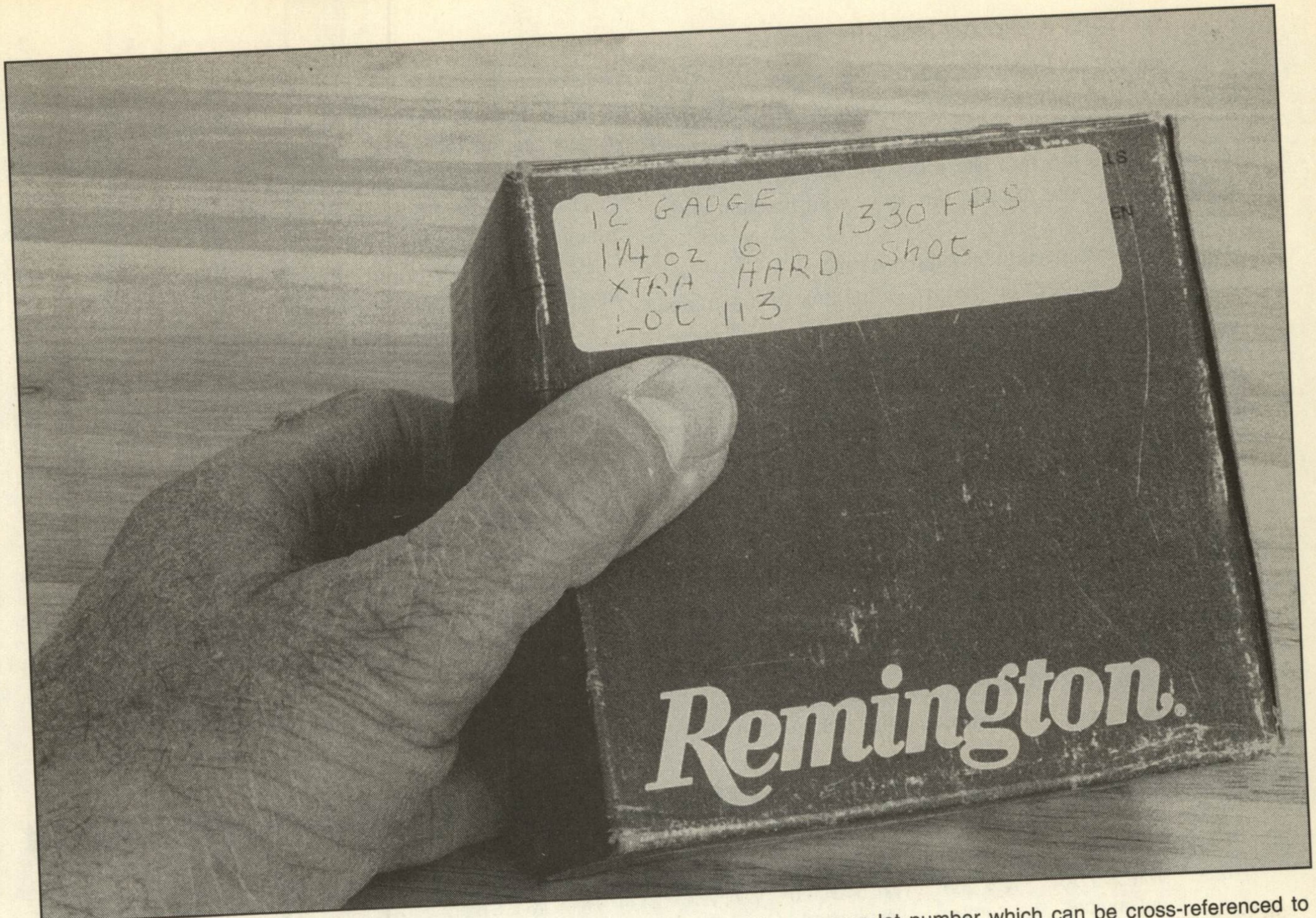
UNLIKE MOST RIFLE and handgun reloading components, not all shotshell components are marked with individual lot numbers. Shot and wads, as sold to the reloader, are generally without any lot number identification. Primers and powder, however, almost always are carefully marked with lot identification numbers on each container. Cases are, for the most part, obtained once-fired, thus separated from their original factory ammo boxes and lot number identification.

The lack of identification places special demands on the shotshell reloader's record-keeping system. But perhaps not all reloaders understand why the ammo box label information is not sufficient to ensure repeatability of performance and safety. Allow me to explain.

A worst case and brief scenario would be that you have just broken your first twenty-five straight birds on the Skeet or trap field (or, perhaps, as with our better-than-average readers, your first 100). You are really content with yourself and your reloads and will probably want to load the same recipe again. After all, you've just proven that it is ballistically uniform and it patterns well. So, you reference the label and if you are typical of many shotshell reloaders, it says something like: 12-gauge, Winchester 209 primer, 1$^1/_8$ ounces #7$^1/_2$ shot at 1200 fps.

Well, to duplicate the load, you need to know exactly what case was loaded. Not to worry—you know by looking at the empties that it is a Winchester AA 2$^3/_4$-inch case. So, while the records were incomplete, no problem exists, so far. Now, the primer used is clearly stated; again no problem, as of yet. How about the precise powder speed, charge weight and metering bushing number used (assuming you have only one bushing of each size). No? Well, there is a problem. Perhaps you use only one powder type and one specific bushing. You may still have a problem. Each new lot number (marked on the can) of powder has, as we have previously discussed, the potential of throwing a different charge than any other lot of the same type. Knowing only powder type and bushing may be insufficient to truly duplicate that super-performing load. What about wad type? You must know exactly what wad was used. And is simply #7$^1/_2$ shot size sufficient? What brand shot was it? Was it soft, hard or extra hard, or even plated shot? You may or may not have the answers to these questions.

What's more, if you didn't record the average overall length of the loaded round, you may not be able to duplicate ballistics. Even if you produce only one load, reloading tool dies can go out of adjustment—but how will you know?



Record-keeping is essential and begins with marking each lot of ammo with your own lot number which can be cross-referenced to detailed records.

There is a completely different scenario that may have you wishing you kept very detailed records. You are reading a shooting/reloading publication and note an ad placed by the manufacturer of your favorite powder or primer. In brief, the ad says that a substandard product has left the maker's factory despite all their precautions to prevent such problems. They are, therefore, recalling the specific component and warning that its use is potentially dangerous. They are very specific as to what individual cans or boxes are involved, and they identify these by the products lot number (a code that tells the manufacturer the exact date and shift during which the product was packaged).

Being concerned, and rightly so, you look at your component packaging and find that your lot number is not one of those being recalled. But you also realize that you have more loaded rounds than could have possibly been assembled from your current containers and, of course, the empty containers have long since been discarded. How can you determine if your ammo was loaded with any of the faulty product? If your reloading records show the lot numbers of the components you used, there is no problem. But if you have never before given lot numbers a second thought, you will have no way of determining if your ammo is safe. Also, you have no idea if the ammo should be discarded and, possibly, if there is a need for the firearm to be checked by a competent gunsmith for possible damage.

How about this: For some reason, your shotgun fails catastrophically (or perhaps not so catastrophically). You contact the manufacturer. And after all is said and done, they declare you have been using reloads (and believe me they can almost always determine this) and these were obviously faulty. Thus, they state they have no responsibility for the gun damage or any physical injury incurred. Should you decide that you are not at fault and pursue the matter, you may well find that if you can't prove your innocence, you will not get much sympathy from a jury. One of the most important tools you will need to gain the jury's attention is a very complete set of reloading records.

It would be easy to cite a number of specific instances where I was called to court as an expert witness. I will save the space and simply say that I have not personally been involved in a single case where the reloader could establish that he was a safe and careful ammo assembler, let alone supply anything that could even begin to suffice as a record of reloading practices and specific methods of assembly. Most could not even begin to establish exactly what components had been used or even where they had been purchased. As sure as you are reading this, any opposing lawyer worth his salt can, under such circumstances, make the reloader look completely incompetent and perhaps even convince the jury that some other brand or quantity of components may have been erroneously used.

Record Keeping Requirements

What can you do to prevent any of those three situations? The answer is to maintain *complete and detailed records.* Remember that the extent to which records are maintained cannot be carried too far. The more you know, can tell, or even prove about your reloads, the better your position under any circumstance.

To begin, records need to take three forms:

1. The label that goes on the individual box of assembled ammo.

2. The record that shows exactly what was loaded, how it was assembled, and to what dimensions.

3. The record that contains all other pertinent information and observations.

Labels

A useful reloading label will contain all of the basic load data that you might want to know when selecting ammo for specific use. For example, I mark my boxes with gauge, shell length, shot charge weight, shot type, shot size and velocity, and assign my own lot number. For example, 12-gauge, 2³/₄", 1¹/₄ oz., Extra Hard, #6, 1330 fps.

The most important bit of information required is not the shot charge weight nor the pellet type and size, but the lot number you assign to a homogeneous group of reloads. With the proper record keeping, this lot number will allow you to reference *anything* you or anyone else may ever want to know about the assembled ammo, and to do so at any time.

The lot number should not be a sophisticated code as used by manufacturers. After all, you are not trying to keep any trade secrets. Simply start with lot number 1 and progress as required. It is, however, extremely important to be very sophisticated as to what the lot number means.

As reloaded, each lot of ammunition must meet specific criteria. All the ammo of a specific lot must have been assembled at the same time, with a single setup of tool dies (no changes or adjustment or anything, no matter how seemingly insignificant), and each specific component must be from the same factory applied lot number or package. In short, every single round must measure exactly the same; contain the same charge weights; and have the identical primer, wad and shot as every other round within the tolerances made possible by the loading press used.

Therefore, when applying a lot number to your reloading labels, you will enter this number into two separate record books. The first book will have provisions for all of the following:

A. Lot number for a group of homogeneous ammo.

B. The date that the ammo was assembled.

C. The brand and specific case description, as well as the manufacturer's lot number (if any). If there is no manufacturer's lot number, apply one of your own and cross-reference it to the second record book. Also important is to record the number of times the case has been fired.

D. The primer brand, style identification number and manufacturer's lot number.

E. The powder brand, type, average charge weight and manufacturer's lot number.

F. The wad brand, specific style identification, and manufacturer's lot number (if any). If there is no manufacturer's lot number, apply one of your own and cross-reference it to the second record book. In addition, note the wad pressure used.

G. The brand of shot, type (hard, magnum, etc.), size, as well as nominal and actual average charge weight, and the manufacturer's lot number (if any). If there is no manufacturer's lot number, apply one of your own and cross-reference it to the second record book.

H. The type of crimp applied and its approximate depth.

I. The approximate average overall length of the loaded rounds.

As an example, the page headings and a sample entry of the first loading book might appear as below:

TABLE 1

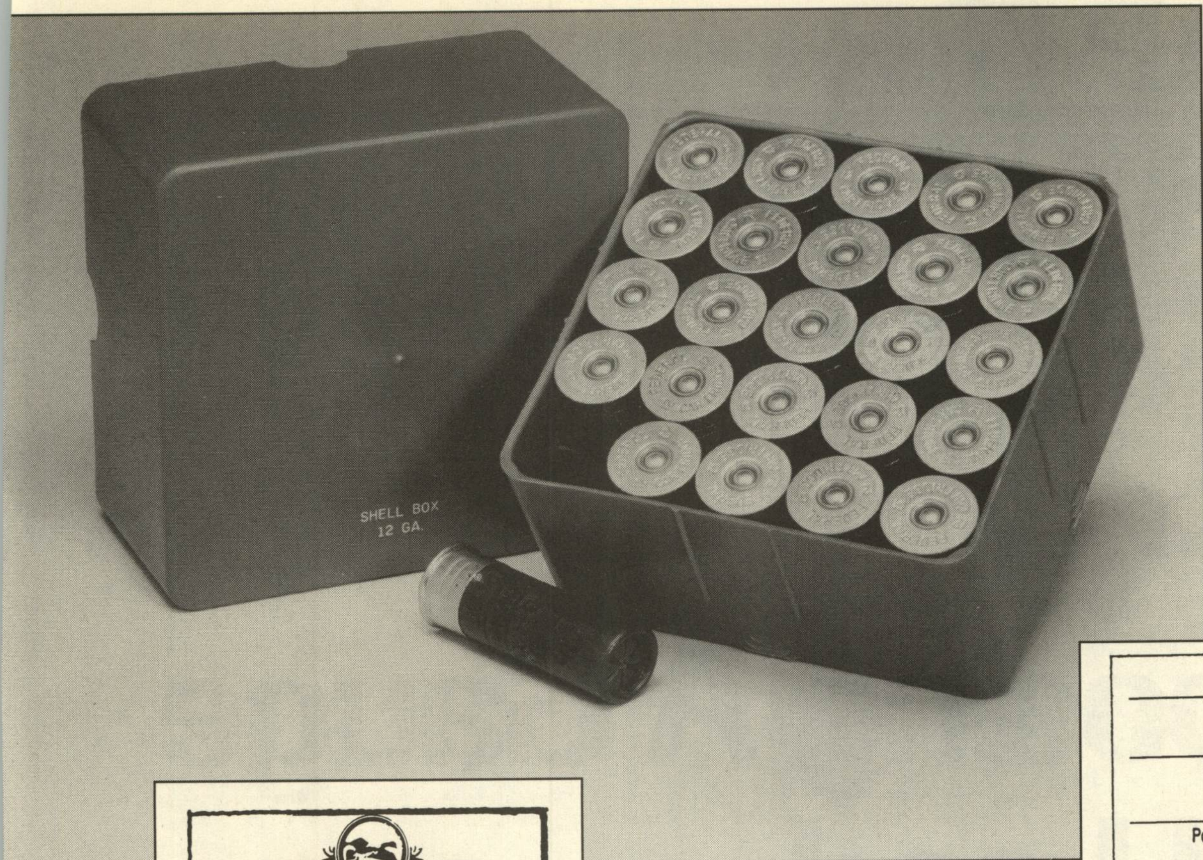
SAMPLE ENTRY

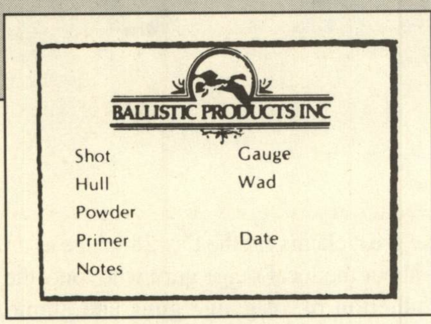
Lot#	Date	Case	Primer	Powder (type/grs.)	Wad	Shot (type/oz.)	Crimp (ins.)	Length (ins.)	Velocity (fps)	Pressure (psi)
1	1/1/93	Win. 2³/₄" AA (lot number) fired 3x	Win. 209 (lot number)	Win. 540/00.0 (lot number)	Win. WAA12114 (lot number) 20 pounds press.	Rem. #6 Ex. hard/ 1¹/₄	8-point .050	2.61	1330 Manual No. 3	11,000

In the example, the first entry is the lot number you apply. The date entry is self-explanatory. When entering the case, use the manufacturer's lot number from the ammo box or apply your own lot number which will be cross-referenced to the second book of records. Use manufacturer's lot numbers for primer and powder. Handle wad and shot lot numbers as done with the case. Enter the crimp depth as best as can be measured; the same for loaded case length. Use velocity and pressure as listed by the data source or actual testing. Any additional information you may want to keep, such as pattern performance, recoil characteristics, etc., as well as all other pertinent data, will be entered into the second record book which is arranged simply by date.

Into the second book will go a great number of items, starting with a purchase record of all components, tools and accessories. This entry should include the type of component purchased, the quantity, and the manufacturer's lot number. On components not having a lot number, apply your own and make it easy to interpret. An example might note the date and source—12/12/93RGSEL for December 12, 1993, Ron's Gun Shop, East Lyme. This will be the lot number placed in your other record book.

Also, the second record book would have any pertinent data pertaining to the actual assembly of a lot of ammo. You may want to indicate the date and then lot number entries that

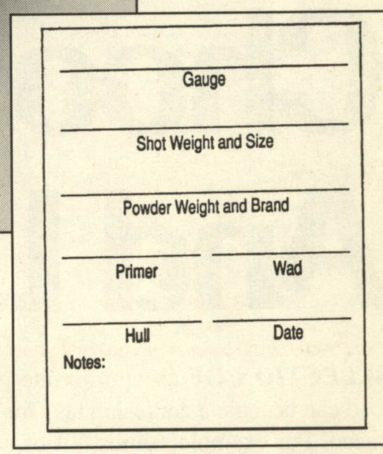




BALLISTIC PRODUCTS INC

Shot Gauge
Hull Wad
Powder
Primer Date
Notes

Once your loads are assembled and boxed, it's too late to ask, "Are they all the same?" Careful record keeping and labeling can help avoid confusion and ensure safety. Labels like these can be purchased from a number of sources.



Gauge

Shot Weight and Size

Powder Weight and Brand

Primer Wad

Hull Date

Notes:

reflect any observations you have made. An example might look like this:

"7/7/93 Lot 33: The new lot of powder proved less dense than previous lots, and the bushing size had to be increased from the previously used #23 to a #24. The cases required an extra amount of sizing effort, having been fired in my over/under which has large chambers. The powder color was somewhat lighter than previous lots. A call to the manufacturer confirmed this (less graphite used on this lot). Crimping die had to be adjusted to produce satisfactory crimp as last loads assembled on press were for much heavier powder and shot weights."

Don't leave anything out of the second record book that occurs to you. You never know what information may come in handy later. In case of an accident, this book will reflect your powers of observation, the care you take in making ammo, and an overall view of your ability to make safe and reliable ammo. Or, this book may enable you to isolate some specific problem. As an example, I remember trying to assemble a specific load I had used for years. However, it just would not go together—the crimp was caved in with a big hole in the center. A review of my records revealed that the only thing different was the lot number of the wads being used. A side-by-side comparison of the new wads with the old ones showed the new ones were considerably shorter. From a call to the manufacturer, I learned the wad had been shortened to make it fit new requirements in factory loading. (Why they kept the old product nomenclature for what was essentially a totally new product is a mystery to me.)

This example also points out why it is essential to always save a few cases, a few primers, some powder, a few wads and some shot from every lot of ammo assembled. Keep these stored as a group and clearly marked with the your ammunition lot number.

Records are essential to safe and sane reloading. They can serve many useful purposes, from duplicating shotshell performance, to quickly working through a problem, to establishing that you are indeed a conscientious reloader. The reloader who finds record keeping too troublesome should, in our opinion, examine whether to continue reloading or, perhaps, to switch to using factory loaded ammo. One accident is always one to many. And sometimes the first accident is the only one for an unfortunate person. Be safe! Keep detailed records!

CHAPTER 17

Choosing A Gauge And Load

SELECTION OF an appropriate gauge, shell length and load can become a confusing task for all but the more experienced. For example, almost all of us can recall articles by "experts" who proclaim the ballistics of the 20-gauge, 3-inch magnum to be equal to a standard 12-gauge. After all, both shells propel a $1^1/_4$-ounce charge of shot downrange.

Other experts proclaim the only waterfowl load worth a hoot is the 10-gauge, $3^1/_2$-inch magnum loaded with BB-size shot. Still others make great claims for the tiny 28-gauge as an upland gun. Or how about the local range guru who touts the need for the reintroduction of 14-gauge guns and ammo because ballistically it is the best balanced shell.

If you have done a fair amount of shotgunning, you will recognize such stuff as nonsense. Nonetheless, how can you decide between #5 or #6 shot, and is $1^3/_8$ ounces enough or do you really need to assemble the more expensive $1^1/_2$-ounce

The selection of gauge and shell length depend on application. For example, for use on big game, a 12-gauge gun with a 3-inch chamber would give the best results, and the shooter could look for accuracy from a wide range of 3- and $2^3/_4$-inch slug loads.

The most popular shell choices are 12-gauge 3- and $2^3/_4$-inch loads. The 20-gauge 3- and $2^3/_4$-inch are the second most popular selections.

loads? For pellet size and shot charge weight recommendations, we refer you back to the previous chapters dealing with shot, ballistics, cases, primers, powder and wads for guidelines.

Overall, shotshell gauge and length selection is not nearly as complex as metallic cartridge choices. Today, there are but five generally available gauges. With the inclusion of the various shell lengths, there are still fewer than a dozen basic selections from which to choose. If you are willing to accept some plain-talk advice, the following should be helpful.

The 10-gauge, as well as the 410-bore and 28, are specialized bore sizes that don't lend themselves well to universal applications. The shotgunner who wants to load a do-it-all shell, therefore, has a choice of 20-gauge in two lengths ($2^3/_4$ and 3 inches), the 16-gauge, or the 12-gauge in any of three lengths ($2^3/_4$, 3 or $3^1/_2$ inches). Of these, the 12-gauge $2^3/_4$-inch shell is by far the most popular. It undoubtedly accounts for more than 80 percent of all shotshells loaded. Still, even in these three basic gauges, there is a wide range of performance and ideal applications. A brief discussion of all the available choices is in order.

10-Gauge $3^1/_2$-Inch Magnum

This shell has perhaps two major applications: long-range waterfowl shooting with steel shot and turkey hunting with lead pellets. Federal mandates requiring waterfowl hunting to become the exclusive domain of steel shot have assured renewed interest in the 10-gauge magnum. Constraints on reloading steel shot make this gauge and its applications of limited appeal to few shooters. With the high cost of many 10-gauge guns, the turkey hunter also may find it a less than desirable selection. But those who can afford the price of admission will find this shell extremely effective for either application.

Turkey hunters who reload the 10-gauge are often interested in dense patterns and long ranges. The best results will be with the larger pellet sizes, within the confines of legal sizes and safety restraints. There is not a great deal to choose among the listed loads. The Remington SP10 wad is likely to be the only one available, and at that it will have to be specially ordered in most retail outlets.

Most other shotgunning applications would be better served by any other gauge. The humongous recoil is seldom mastered by any but the most experienced shooters. For these few, the 10-gauge does have its place. Still, for shots to 50 yards or less, a good gunner can get along just fine with a long-chambered 12-gauge. The average shotgunner would do best to pass on the few shots beyond 50 yards and instead use a shell that enables him to master the art of shotgunning.

12-Gauge $3^1/_2$-Inch Magnum

This newest 12-gauge shell length would never have been developed if it weren't for steel shot waterfowl requirements. But, it is a natural for turkey hunting with lead pellets. And, of course, the shorter 12-gauge shells can be fired in the long $3^1/_2$-inch chamber of current guns. There are not many guns chambered for this length at this writing, and so far its popularity is limited. As time passes, however, I would expect waterfowlers to develop a strong interest in this shell, leading to more $3^1/_2$-inch guns.

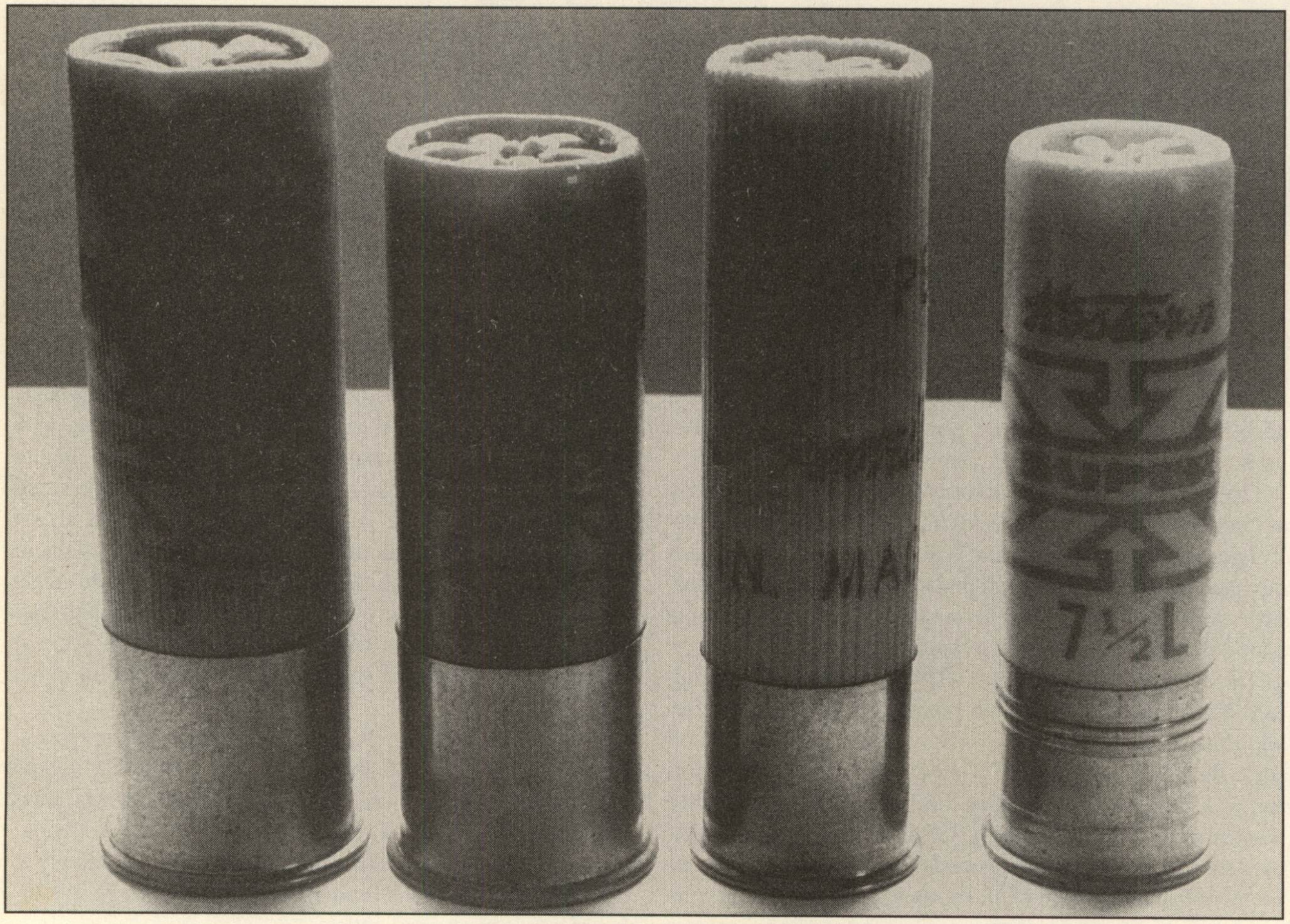
The user of this shell obviously wants dense patterns with the larger shot to maximize long-range performance. However, handloading is handicapped by a complete lack of wads with a shot cup long enough to protect the heavy pellet charges. And, data for this case length is necessarily limited. No manufacturer wants large expenditures to develop extensive data for a shell that currently sees very limited use. So, the greatest appeal of the $3^1/_2$-inch gun is its versatility in using the 3- and $2^3/_4$-inch shells. The wide range of ammo allows for the maximum in application versatility.

12-Gauge 3-Inch Magnum

The 12-gauge, 3-inch magnum shotgun is very versatile. Almost all 12-gauge, 3-inch guns will accept standard 12-gauge, $2^3/_4$-inch ammunition. The exceptions include some automatics that function only with *high-velocity* 12-gauge, $2^3/_4$-inch loads.

Unlike the $3^1/_2$-inch guns, those chambered for this shell are often as light and graceful as any $2^3/_4$-inch-only gun. Thus, added versatility can be had without sacrificing the good handling characteristics essential to an upland shotgun. Obviously, it is easy to use the same gun for waterfowl, turkey, big game, upland hunting and target shooting simply by selecting the appropriate shell length, shot charge weight and pellet size.

The 12-gauge, 3-inch shell has already become extremely popular due to federal steel shot regulations. The extra $^1/_4$-inch of shell length gives a lot of needed case volume for the less dense steel pellets.



For turkey hunting, some specialized shooters will select the 10-gauge $3^1/_2$-inch magnum shell, but good results can be had from 12-gauge loads also.

Of course, the 3-inch shell offers no great advantage other than for long-range waterfowl shooting and the assembly of heavy turkey loads. Shot charge weights of $1^5/_8$, $1^3/_4$, $1^7/_8$ and 2 ounces are generally not possible in shorter cases. The heaviest charges can be loaded to about 1175 to 1200 fps. Higher velocities are proportionately available as shot charge weight is reduced. It is possible to load lighter charges in the 3-inch case, but loads lighter than $1^1/_2$ ounces are not ballistically well-balanced, and appropriate wads for light loads are not generally available.

Keep in mind that the heaviest shot charge weights are not always the best selections. For example, when the temperature drops to around 10 degrees F or below, velocities begin to fall off noticeably. The $1^7/_8$- and 2-ounce loads then may begin to fail to kill cleanly at long ranges. Under these conditions, the lighter $1^5/_8$-ounce load at a muzzle velocity of 1280 fps will do a better job. Additionally, many shotgunners have found that this load often gives the most uniform patterns.

12-Gauge $2^3/_4$-Inch

The steel shot requirements for waterfowl and turkey hunting are the two applications that keep this shell from being an ideal do-everything round. The range of factory lead shot loads include 1, $1^1/_8$, $1^1/_4$, $1^3/_8$ $1^1/_2$, and $1^5/_8$ ounces, in all pellet sizes BB to #9. Also available are 000, 00, 0, #1 and #4 buckshot, as well as 1- and $1^1/_4$-ounce slugs. Everything from tiny rail birds to deer and black bear have been successfully hunted using a $2^3/_4$-inch 12-gauge shell. With the heaviest loads, recoil is stiff, but light $1^1/_8$- or 1-ounce loads can deliver recoil and ballistics on par with a 20-gauge. And the handloader is able to duplicate this versatility.

Other than a desire for an extremely lightweight shotgun, there are few reasons to select a gauge smaller than this in light of the newer designs offered. A good example of this is the Remington 870 Special Field. Some 12-gauge guns are light enough to compare favorably with many 20s. Admittedly, if only small upland birds and long walks make up all of your shotgunning, then a gauge smaller than the 12 may be justified.

The standard length 12-gauge $2^3/_4$-inch case has been the overwhelming first choice of most gunners. It has earned its popularity many times over. Internal ballistics with shot weights from 1 to $1^1/_2$ ounces are the epitome of uniformity. Almost every case type can be assembled with this wide range of shot charges.

Choosing this gauge/length can mean light shot weights of 1 or $1^1/_8$ ounces at low velocity (up to 1145 fps) for the beginner or recoil-shy shooter; the target shooter and upland hunter can use light- to mid-weight shot charges of 1 to $1^1/_8$ ounces (the latter is most popular) at mid-range velocity (1145 to 1200 fps); for general field work, $1^1/_4$ ounces at velocities from 1100 to over 1300 fps works well; for the most demanding applications, heavy charges of $1^3/_8$ or $1^1/_2$ ounces pushed as fast as possible are sometimes chosen. Each of these and a great many in-between levels can be accomplished easily with this shell.

Of course, it is not possible to assemble such a wide range

For waterfowl only, or perhaps combined waterfowl and turkey applications, a 12-gauge $3^1/_2$-inch shell would prove satisfactory for shooters able to handle the heavier recoil of loads from the longest 12-gauge shell.

For general field (and target) applications, a shotgun chambered for 12-gauge 3-inch shells will allow the use of the very wide range of loads available in both 3- and $2^3/_4$-inch shells. Thus, shot charge weights from 1 to 2 ounces will be possible.

of loads with a single adjustment of the press tooling, even if the same case brand and style is used. As shot charge weights increase, die adjustments will become essential. Moreover, wad seating pressure may also require adjustment. However, a few minutes with a screwdriver and wrench can make this a wonderfully versatile selection.

16-Gauge $2^3/_4$-Inch

The 16-gauge is a semi-obsolete gauge in this country. With respect to the big factories, it represents perhaps 15 percent of all shotshell sales. Still, 16-gauge fans consider their choice anything but defunct.

A recent effort to revive the gauge was undertaken by Browning a few years ago when they brought back their A-5 "Sweet Sixteen" semi-automatic shotgun in 16-gauge. Indeed, this was the original chambering for the A-5, with the 12 and 20 coming only after the general acceptance of the design. One could say the original A-5 made the 16-gauge successful—or the inverse. The recent reintroduction of the 16-gauge A-5, as well as other guns, certainly did not create a renewed wave of interest in this gauge.

Many 16-gauge fans like to tout the fact that a 16-gauge gun can be built lighter than a 12 and deliver more punch than a 20. This is technically true, but in practice American firearms manufacturers made almost all 16-gauge guns on 12-gauge receivers, thereby negating almost all of the weight advantage. So, if the two guns weigh about the same, why not have the advantages of all the various 12-gauge loads? They start as light as the lightest 16-gauge load (1 ounce) and go far beyond the heaviest ($1^1/_4$ ounces). Most shooters subscribe to this practical thinking, hence the general and nearly total lack of interest in the 16.

The major problem in loading for the 16-gauge is the dearth of wads. Winchester makes a single 16-gauge AA type and Remington now offers only one Power Piston-style wad, the SP16. Beyond these two, the average reloader will find it nearly impossible to locate any other suitable wad from one of the "majors." The general availability of only two wads makes it difficult to come up with a wide range of suitable loads. For those who do not mind specially ordering components, Activ offers a 16-gauge wad suitable for use in their unique case.

It appears the only bright spot for the 16 is Ballistic Products, Inc. This up-and-coming enterprise is able to supply their G/BP 16 wad for 1-ounce loads, as well as the G/BP 16 Dispersor-X, Spreader-X and Waxed Hard wads. In addition, they offer Dangerous Game Slugs for the gauge.

Still, there are a very limited number of practical loadings, and most of these are $1^1/_8$-ouncers. It is possible to assemble a few $1^1/_4$-ounce loads, but it usually becomes impractical to attempt 1-ouncers. However, we list a fair selection of 1-ounce loads which require carefully adjusted dies. Because of the limitations on $1^1/_4$-ounce loads, these few recipes have been bulked into the field load data section, rather than make a heavy field load section for but three or so loads.

Users of 16-gauge guns should always be careful to verify chamber lengths before using, or loading, any ammo.

Originally, all 16-gauge guns were chambered for a short $2^9/_{16}$-inch shell. All current ammo uses a $2^3/_4$-inch case. The use of $2^3/_4$-inch shells in a $2^9/_{16}$-inch chamber is an unnecessary hazard and should be avoided.

Because of ballistic restraints, the faster burning propellants often used in 12-gauge target loads are not ideally suited for loading the 16-gauge shell. Propellants such as Hi-Skor 700-X, Red Dot and others are generally best avoided. Instead, Hi-Skor 800-X, SR 7625, Unique, Herco, and Blue Dot are the best selections. For $1^1/_4$-ounce magnum loads, Winchester 571 or Hercules Blue Dot work well.

Because of the limited number of available wads, be alert to any changes in wad pressure required when selecting data. Minimum wad pressure should be maintained at 20 to 40 pounds. An increase in wad pressure will be required for the $1^1/_8$-ounce loads using Blue Dot. The $1^1/_4$-ounce loads shown in our tables will require a substantial increase in wad pressure, perhaps to 60 pounds depending on the tool's crimp die adjustment.

It is important to realize that while most of the $1^1/_8$-ounce loads shown in our data can be assembled with similar crimp die adjustment, the $1^1/_4$-ounce loads often will require adjustment of the crimping die (and cam on MEC tools). A somewhat shallow fold and a good inward bevel on the case mouth will help ensure a good-looking, non-popping crimp with the $1^1/_4$-ounce loads.

The listed data will load uniformly and without difficulty with shot sizes #8 to #6. When using #9 shot, it may be necessary to adjust the crimp die slightly for good closure. Number 4 shot, the largest practical for the 16-gauge, will usually meter noticeably light from most bushings.

Though generally limited to $1^1/_8$- and $1^1/_4$-ounce charge weights, the 16-gauge is a versatile shotgun suitable for many applications. Target loads using $1^1/_8$ ounces of shot can be assembled to duplicate many popular 12-gauge target loadings (1145 to 1200 fps). At somewhat higher velocity, the same shot charge will be useful for many field situations. For more demanding shooting, such as long-range pheasants, the $1^1/_4$-ounce loads should be chosen.

20-Gauge 3-Inch Magnum

The 20-gauge 3-inch chambering makes a versatile lightweight shotgun if the applications are no tougher than light upland hunting. It is a long stretch to expect this shell to double as a modest-range waterfowl or pheasant load, except possibly in the hands of a true expert at modest range.

The heaviest 20-gauge 3-inch lead shot load is $1^1/_4$ ounces at 1185 fps, but this velocity is extremely hard to duplicate

For strictly short-range or light upland use, a 16-gauge gun will almost always prove satisfactory.

with reloading components. In other words, this case is a ballistic midget compared to a 12-gauge 2³/₄-inch shell, which easily drives the same shot weight at 1330 fps or more. And because of its longer shot column, the 20-gauge will deliver a somewhat less dense pattern. However, when there is only an occasional need for 1¹/₄-ounce loads, the 3-inch 20 can do a fair job on some tasks normally best accomplished with a 12. Because the 3-inch Magnum nomenclature might tend to make many folks think of heavy field loads, we have listed data for it in this category.

20-Gauge 2³/₄-Inch

Our second-best seller, the 20-gauge 2³/₄-inch shell, is sometimes over-extended in applications. Its heaviest load pushes a 1¹/₈-ounce shot charge at 1175 fps. This is the 20's 2³/₄-inch "magnum" load. Ballistically, it is squarely between the two popular standard 12-gauge 1¹/₈-ounce target loads at either 1145 or 1200 fps. The standard 20-gauge high-velocity field load uses a 1-ounce charge at 1220 fps. Compare this to the 12-gauge 1-ounce target load at 1180 fps or the 12-gauge 1-ounce field load at 1290 fps. Obviously, the small 20-gauge 2³/₄-inch shell, even with its heaviest loadings, is still ballistically about equivalent to the lightest 12-gauge loads.

Considering its potency, the 2³/₄-inch 20 is ideally a good upland bird, squirrel or rabbit gauge. Also, it can make the challenge of Skeet or Sporting Clays quite exciting. From a sporting point of view, the 20 should not be a prime selection when there is a consistent need to bag pheasants at ranges that exceed 35 yards, or when there is a need to take deer or bear with either slug or buckshot.

Still, the delight of a 20-gauge loaded with an ounce of #7 shot on grouse and woodcock or other light upland cover cannot be matched. For this game and habitat, the 20-gauge will get the job done admirably. And it will do it with a gun that is light enough to carry all day over hill and dale.

The standard 20-gauge is also the correct choice for any recoil-sensitive shooter, especially if a semi-automatic is used. It can make it a delight to shoot several hundred clay birds at one time. For these purposes, the ⁷/₈-ounce load at 1200 fps is standard, albeit lower velocities will further reduce recoil.

When heavy cover and/or long treks demand a light, fast-handling gun, many shotgunners will choose a 20-gauge gun chambered for 2³/₄- and 3-inch shells.

28-Gauge 2³/₄-Inch

Though its fans would argue strongly against such statements, the 28-gauge is only a short-range shell capable of taking small upland birds, squirrels and rabbits. If the range exceeds much more than 25 yards, a larger gauge will help prevent the high percentage of cripples common with the 28. The 28 is best on a Skeet field rather than in the game field. There are, of course, a fair number of small bore fans who take their fair share of quail, rabbits, woodcock and other small upland game, but the number of clean, instant kills versus cripples is not what I consider impressive. At ranges greater than 75 feet, even some of the great shots find a frequent need to administer the coup de grace themselves, if their dog doesn't do so first.

Traditionally, the 28's target and field loads used the same ³/₄-ounce load. However, small lots of factory field loads have been produced with both ⁷/₈- and 1-ounce shot charges. These cannot be duplicated with generally available reloading components.

410-Bore 3-Inch

The 410's name is reflective of actual bore diameter in inches—0.410. Therefore, it is not correct to refer to it as 410-gauge, but rather 410-bore.

The 410 is considered by some as no more than a stunt gun if used in the hunting field. Granted, quite a few junior shooters are handicapped with it by well-meaning parents. But if these same folks attempted to hunt with it before placing one in a

If all shooting will be limited to very short ranges, such as when a close working dog is used, even a 20-gauge $2^3/_4$-inch-only gun can get the job done nicely. And such selection can be a lot of fun for Skeet shooting, too.

youth's hands, we would have fewer frustrated junior shooters. With carefully placed patterns, it is sufficient for rabbits, squirrels and small birds up to an absolute maximum of 20 yards. Past this range, the average shooter will find it next to impossible to score clean kills. The author used a 3-inch 410 for years on rabbits when he was a teenager and never killed one past 20 yards except when two shots were taken. The first shot would invariably roll the rabbit, and it was quickly learned that a second shot was required to accomplish a clean job—and this only if the range did not exceed two dozen yards.

It is ludicrous to use shot larger than #$7^1/_2$ with the tiny total charge weight of only $^{11}/_{16}$-ounce. There are precious few pellets in this load, and larger shot will reduce the pellet count even more, making multiple hits more of an accident than a plan. Smaller size pellets will not fit most hunting situations, so this gauge should be synonymous with only #$7^1/_2$ shot.

410-Bore $2^1/_2$-Inch

This shell is solely for making the challenge of Skeet shooting as difficult as possible. Regardless of the shooter's proficiency on the Skeet field, the use of the $2^1/_2$-inch 410 with its sparse $^1/_2$-ounce load of shot is simply not sporting. The eleventh commandment would have been "Honor thy quarry and present not to it a blow that is expected to be less than promptly fatal."

Load Selection

Loads are listed in the data section by category of application. The groups of applications are Heavy Field, Field, Light Field and Target loads. Buckshot and Slug loads are listed in the appropriate section. All categories start with the largest gauge and work down. Loads are also grouped by shell type.

The Heavy Field loads are those suitable for the most demanding applications like turkey hunting or very long-range pheasant hunting. These include all 10-gauge $3^1/_2$-inch and all 12-gauge $3^1/_2$- and 3-inch loads. Also included are the heaviest shot weights for the 12-gauge $2^3/_4$-inch shell, such as $1^1/_2$ and $1^3/_8$ ounces, as well as the highest velocity $1^1/_4$-ounce loads. Also in this section are 16-gauge $1^1/_4$-ounce and all 20-gauge 3-inch loads. The 20-gauge $2^3/_4$-inch $1^1/_8$-ounce magnum loads are also shown here.

The Field load grouping includes those which are generally standard to the gauge—12-gauge $2^3/_4$-inch $1^1/_4$-ounce standard velocity, lighter 12-gauge charges of $1^1/_8$ ounces at high velocity, 16-gauge $1^1/_8$-ounce high velocity, and all 20-gauge 1-ounce loads. These are most often used for upland hunting.

The Light Field load group includes those suitable for the lightest hunting situations. These might be used for rail birds and quail, and might be employed by recoil-shy shooters. Included are 12- and 16-gauge $2^3/_4$-inch $1^1/_8$-ounce loads at standard velocity, 20-gauge $^7/_8$-ounce loads at high velocity, 28-gauge high-velocity loads, and all 410-bore 3-inch types. The entries in this group often overlap into the Target load groups. Any extra-light loads are listed here, too. Therefore, there may be a duplication of loads in these two categories in order to keep load location as simple as possible for the reader.

The Target load group lists all the loads which duplicate accepted factory target loads in 12-gauge through 410-bore.

LEAD SHOT LOADING TABLES

Introduction To Lead Shot Load Data

BEFORE USING any of the listed load data, all of the preceding material in this book must be carefully read and fully understood. Reloading demands a great deal of knowledge and understanding. It is not possible to simply purchase a reloading tool, select a load from the data and then expect the assembled ammunition will be safe and fit for specific applications.

It is the reloader's responsibility to ensure the safety and suitability of any and all ammunition assembled. It is also the reloader's responsibility to use only the latest reference material. The information in these pages will become obsolete, and should no longer be referenced, as soon as a later edition is published, or at such time that any manufacturer changes the ballistic properties of any listed component, or at such time as any component manufacturer alters any published data.

Caution: *The data contained in this section is intended for informational purposes and is only for use by experienced shotshell reloaders. Neither the publisher nor author have any control over the manufacture of reloading components.*

Careful reloading at the bench can pay off in the field. With thorough research and practice, the reloader can tailor his loads to meet his specific needs.

Nor do they have any control over the individual reloader's methods of assembly, tools used, components selected or loaded ammunition dimensions. Thus, no warranty is intended, expressed or implied as to the suitability of any of the information contained in this book for any specific application. The data listings are supplied for comparative purposes only.

Load Categories

The data in these pages has been arranged by load application type. The listed categories are as follows: Heavy Field loads, Field loads, Light Field loads and Target loads. The interpretation of these divisions is, of course, subjective. For example, in the Heavy Field, there are data for 10-gauge 3½" 2-ounce loads as well as 20-gauge 3" 1¼ ounces.

Heavy Field Loads: This data includes loads that are essentially on par with factory magnum or high-velocity ammunition. Specifically, the following loads are included in this section: 10-gauge 3½"; 12-gauge 3½"; 12-gauge 3"; 12-gauge 2¾" 1⅝-, 1½- and 1⅜-ounce; 12-gauge 2¾" high-velocity 1¼-ounce; and 20-gauge 3".

Field Loads: This load data is for ammunition that will generally duplicate the performance of standard-velocity factory ammo and with lighter shot charges at both high and standard velocities. The factory loads that fit this description are becoming fewer. This area of data gives the 12-gauge reloader the ability to select loads that have less recoil, but will still deliver solid field performance. By nature, the 16- and 20-gauge loads in this group are the heaviest loads practical. Field loads are listed for gauges as follows: 12-gauge 2¾" standard-velocity 1¼-ounce; 12-gauge 2¾" high-velocity 1⅛-ounce; 16-gauge 2¾" high-velocity 1⅛- and 1¼-ounce; and 20-gauge 2¾" 1⅛-ounce.

Light Field Loads: These loads are for non-demanding applications. They often have lighter shot charge weights and/or lower velocity than many field loads. Loads in this category are shown for 12-gauge through 410-bore. There are some duplication of these loads with those of the target loads listed. The specific loads shown in this section: 12-gauge 2¾" standard-velocity 1⅛-ounce, and high- and standard-velocity 1-ounce; 16-gauge 2¾" standard-velocity 1-ounce; 20-gauge 2¾" 1-ounce, and high- and standard-velocity ⅞- and ¾-ounce; 28-gauge 2¾" 11/16-ounce, and high- and standard-velocity ¾-ounce; and 410-bore 3".

Target Loads: These have been selected for their ability to provide the maximum in ballistic uniformity. Loads are listed for all gauges from 12 to 410-bore in this section. Target loads are kept to a maximum velocity of 1200 fps. These loads can also be used as light field loads. The target loads listed are assembled with the fastest burning propellants. This exclusivity of listings ensures that the serious and frequent shooter will have the cleanest burning loads possible, as well as the most economical powder charges. Reloaders who wish to use slower burning propellants will get somewhat less uniform ballistics and dirty burning. For such data, we refer you to the propellant manufacturer's data. Listed are 12-gauge 2¾" 1⅛- and 1-ounce; 16-gauge 2¾" 1-ounce; 20-gauge 2¾" ⅞-ounce; 28-gauge 2¾" ¾-ounce; and 410-bore 2½" 11/16-ounce.

As stated in other parts of this book, it will not be possible to duplicate the performance of factory target ammo unless shot of equal hardness and quality is used.

Data is broken down, as stated, into load types, from heaviest to lightest. It is next broken down into case brand and type groupings. Be certain you are using the exact case as listed in the data. Should doubt exist, contact the case manufacturer and obtain an answer *before* beginning to assemble ammunition. The use of the wrong case, even though it may be of the same gauge, length, brand and color, can be extremely hazardous.

Caution: *The listed data must be used exactly as shown. No substitution of cases, powder, primers or wads can be made without affecting the ballistic levels of the loaded ammunition. There is no way to predict the ballistic direction that can be caused by an untested component substitution. Substitutions can prove very dangerous, even when the substituted component has similar nomenclature. Follow the data exactingly.*

Wads

When loading multiple wad columns, insert the wads into the case in the order shown. Variations from this procedure could have a negative impact on ballistics.

Velocities and Pressures

All velocities are rounded to nearest factory similar dram equivalent load level. This may mean a rounding of +/- 20 fps. All pressures are rounded to nearest 500 psi/LUP. Psi and LUP readings are not interchangeable.

About Our Load Selections

There are more than 7000 shotshell loading recipes available to the reloader. When a manufacturer lists data, one of the criteria is sometimes to show the maximum number of propellant applications possible. Even some data-only publishers follow this approach. The advantage to this type listing is that it is often possible to find a recipe to fit a very wide range of components. The drawback is that not every listed load will give the best possible ballistic uniformity.

The loads listed in our data pages were selected by the author with an intention to list the best of the best with respect to ballistic uniformity. Exceptions were made only when the combination to be loaded was not possible to assemble with extremely tight ballistic uniformity.

Your comments on our data selections are always welcome although we are unable to supply individual responses. Address comments to Ed. Matunas, P.O. Box 511, Moosup, CT 06354.

Warning: *Never use lead shot with steel shot data and never use steel shot with lead shot data. Lead and steel pellets have drastically different ballistic properties and to mistakenly use one for the other can cause serious property damage and/or personal injury—even death. All the data contained in this data book are for lead pellets only!*

Heavy Field Load Index

10-Gauge $3^1/_2''$ Shells

12-Gauge $3^1/_2''$ Shells

12-Gauge 3″ Shells

12-Gauge $2^3/_4''$ Shells

20-Gauge 3″ Shells

Heavy Field

10-Gauge — 3½″ Shells

Case	Shot Wgt. in Oz.	Primer	—Powder— Grains/Type	Wad	Velocity fps	Pressure LUP/psi*
Federal Plastic Paper Base Wad	2¼	Win. 209	42.5/Blue Dot	Rem. SP10 1/ 20 ga. ⅛" CW/BSC**	1165	10,000*
	2¼	CCI 209M	42.0/Blue Dot	Rem. SP10 1/ 20 ga. ⅛" CW/BSC**	1165	10,000*
	2¼	Fed. 209	41.0/SR 4756	Rem. SP10	1165	9,700
	2	Win. 209	44.0/Blue Dot	Rem. SP10 2/ 20 ga. ⅛" CW/BSC**	1210	9,500*
	2	CCI 209M	43.5/Blue Dot	Rem. SP10 2/ 20 ga. ⅛" CW/BSC**	1210	9,500*
	2	Fed. 209	46.5/SR 4756	Rem. SP10	1300	10,000
	1⅞	Win. 209	45.5/Blue Dot	Rem. SP10 3/ 20 ga. ⅛" CW/BSC**	1260	10,200*
	1⅞	CCI 209M	45.5/Blue Dot	Rem. SP10 3/ 20 ga. ⅛" CW/BSC**	1260	10,000*
	1⅞	Fed. 209	41.0/SR7625	Rem. SP10 2/ 20 ga. .135" CW/BSC**	1260	9,500
	1⅝	Win. 209	45.5/Blue Dot	Rem. SP10 4/ 20 ga. ⅛" CW/BSC**	1285	8,500*
	1⅝	CCI 209M	45.0/Blue Dot	Rem. SP10 4/ 20 ga. ⅛" CW/BSC**	1285	8,000*
Case	Shot Wgt. in Oz.	Primer	—Powder— Grains/Type	Wad	Velocity fps	Pressure LUP/psi*

** CW/BSC = Card wad inserted into bottom of shot cup.

Case	Shot Wgt. in Oz.	Primer	—Powder— Grains/Type	Wad	Velocity fps	Pressure LUP/psi*
Federal Plastic Paper Base Wad (continued)	1⅝	Fed. 209	37.5/PB	Rem. SP10 3/ 20 ga. .135" CW/BSC**	1285	10,000
Remington Plastic SP	2¼	Win. 209	41.0/Blue Dot	Rem. SP10	1165	10,500*
	2¼	CCI 209M	40.5/Blue Dot	Rem. SP10	1165	10,500*
	2	Win. 209	42.5/Blue Dot	Rem. SP10 2/ 20 ga. ⅛" CW/BSC**	1210	10,100*
	2	CCI 209M	42.0/Blue Dot	Rem. SP10 2/ 20 ga. ⅛" CW/BSC**	1210	10,500*
	1⅞	Win. 209	44.5/Blue Dot	Rem. SP10 3/ 20 ga. ⅛" CW/BSC**	1260	9,100*
	1⅞	CCI 209M	44.0/Blue Dot	Rem. SP10 3/ 20 ga. ⅛" CW/BSC**	1260	10,000*
	1⅝	Win. 209	44.0/Blue Dot	Rem. SP10 4/ 20 ga. ⅛" CW/BSC**	1285	8,500*
	1⅝	CCI 209M	43.5/Blue Dot	Rem. SP10 4/ 20 ga. ⅛" CW/BSC**	1285	8,500*
Winchester Plastic Poly Formed Plastic Base Wad	2¼	Win. 209	42.0/Blue Dot	Rem. SP10	1165	10,500*
	2¼	CCI 209M	41.5/Blue Dot	Rem. SP10	1165	10,500*
	2¼	Win. 209	42.5/SR 4756	Rem. SP10	1165	10,000
	2¼	Win. 209	47.0/571	Rem. SP10	1205	10,000
Case	Shot Wgt. in Oz.	Primer	—Powder— Grains/Type	Wad	Velocity fps	Pressure LUP/psi*

** CW/BSC = Card wad inserted into bottom of shot cup.

10-Gauge – 3½″ Shells

Case	Shot Wgt. in Oz.	Primer	—Powder— Grains/Type	Wad	Velocity fps	Pressure LUP/psi*
Winchester Plastic Poly Formed Plastic Base Wad (continued)	2	Win. 209	43.5/Blue Dot	Rem. SP10 1/ 20 ga. ⅛" CW/BSC**	1210	9,500*
	2	CCI 209M	43.0/Blue Dot	Rem. SP10 1/ 20 ga. ⅛" CW/BSC**	1210	9,500*
	2	Win. 209	48.5/SR 4756	Rem. SP10	1300	10,000
	2	Win. 209	41.0/SR 7625	Rem. SP10	1210	10,000
	2	Win. 209	44.0/540	Rem. SP10 1/ 16 ga. ¼" FW/BSC***	1210	8,700
	1⅞	Fed. 209	39.0/PB	Rem. SP10	1210	10,000
	1⅞	Win. 209	45.5/Blue Dot	Rem. SP10 2/ 20 ga. ⅛" CW/BSC**	1260	10,000*
	1⅞	CCI 209M	45.0/Blue Dot	Rem. SP10 2/ 20 ga. ⅛" CW/BSC**	1260	10,200*
	1⅝	Win. 209	45.0/Blue Dot	Rem. SP10 3/ 20 ga. ⅛" CW/BSC**	1285	9,000*
	1⅝	CCI 209M	35.5/Herco	Rem. SP10 3/ 20 ga. ⅛" CW/BSC**	1285	10,500*
Case	Shot Wgt. in Oz.	Primer	—Powder— Grains/Type	Wad	Velocity fps	Pressure lup/psi*

**CW/BSC = Card wad inserted into bottom of shot cup. ***FW/BSC = Fiber wad inserted into bottom of shot cup.

12-Gauge — 3½″ Shells

Case	Shot Wgt. in Oz.	Primer	—Powder— Grains/Type	Wad	Velocity fps	Pressure LUP/psi*
Federal Plastic Unibody	2¼	Win. 209	38.0/Blue Dot	Fed. 12S4	1160	11,000*
	2¼	CCI 209M	38.5/Blue Dot	Fed. 12S4	1160	11,000*
	2¼	CCI 209M	38.5/Blue Dot	Win. WAA12F114	1160	11,000*
	2¼	CCI 209M	39.5/Blue Dot	Rem. SP12	1160	11,200*
	2	Win. 209	41.0/Blue Dot	Fed. 12S0	1230	10,000*
	2	CCI 209M	42.5/Blue Dot	Fed. 12S0	1230	10,000*
	2	CCI 209M	42.5/Blue Dot	Win. WAA12SL	1230	10,000*
	2	CCI 209M	42.0/Blue Dot	Rem. R12L	1230	10,000*
	1⅞	Win. 209	42.5/Blue Dot	Fed. 12S0	1265	10,100*
	1⅞	CCI 209M	43.0/Blue Dot	Fed. 12S0	1265	10,000*
	1⅞	CCI 209M	43.0/Blue Dot	Win. WAA12SL	1265	9,500*
Remington Plastic SP	2¼	Win. 209	38.0/Blue Dot	Rem. SP12	1150	11,500*
	2¼	CCI 209M	38.0/Blue Dot	Rem. SP12	1150	11,000*
	2¼	CCI 209M	37.0/Blue Dot	Fed. 12S4	1150	11,000*
	2	Win. 209	39.0/Blue Dot	Rem. R12L	1210	11,000*
	2	CCI 209M	39.5/Blue Dot	Rem. R12L	1210	11,000*
	2	CCI 209M	39.5/Blue Dot	Fed. 12S0	1210	11,000*
	2	CCI 209M	39.0/Blue Dot	Win. WAA12SL	1210	10,700*
Winchester Plastic	2¼	Win. 209	37.0/Blue Dot	Rem. SP12	1160	11,000*
Case	Shot Wgt. in Oz.	Primer	—Powder— Grains/Type	Wad	Velocity fps	Pressure LUP/psi*

12-Gauge — $3\frac{1}{2}''$ Shells

Case	Shot Wgt. in Oz.	Primer	—Powder— Grains/Type	Wad	Velocity fps	Pressure LUP/psi*
Winchester Plastic (continued)	2	Win. 209	40.0/Blue Dot	Win. WAA12SL	1210	11,000*
	2	Win. 209	40.5/Blue Dot	Fed. 12S0	1210	11,000*
	2	Win. 209	39.0/Blue Dot	Rem. R12L	1210	10,500*
	2	CCI 209M	39.0/Blue Dot	Win. WAA12SL	1210	11,200*
	$1\frac{7}{8}$	Win. 209	40.0/Blue Dot	Win. WAA12SL	1265	11,000*
	$1\frac{7}{8}$	Win. 209	40.5/Blue Dot	Fed. 12S0	1265	10,700*
	$1\frac{7}{8}$	CCI 209M	39.5/Blue Dot	Win. WAA12SL	1265	10,500*
	$1\frac{7}{8}$	Win. 209	38.5/Blue Dot	Win. WAA12SL	1200	10,000*
	$1\frac{7}{8}$	Win. 209	38.5/Blue Dot	Fed. 12S0	1200	10,600*
	$1\frac{7}{8}$	CCI 209M	38.0/Blue Dot	Win. WAA12SL	1200	10,000*
Case	Shot Wgt. in Oz.	Primer	—Powder— Grains/Type	Wad	Velocity fps	Pressure LUP/psi*

12-Gauge — 3″ Shells

Case	Shot Wgt. in Oz.	Primer	—Powder— Grains/Type	Wad	Velocity fps	Pressure LUP/psi*
Federal Plastic Paper Base Wad	1⅞	Fed. 209	36.0/Blue Dot	Rem. SP12	1155	10,500*
	1⅞	Fed. 209	34.0/Blue Dot	Rem. RP12	1155	10,500*
	1⅞	Fed. 209	34.5/Blue Dot	Activ T35	1155	10,000*
	1¾	Fed. 209	39.0/Blue Dot	Rem. RP12	1245	10,500*
	1⅝	Fed. 209	39.0/Blue Dot	Rem. SP12	1280	10,500*
	1½	Fed. 209	38.0/Blue Dot	Fed. 12S3	1315	9,700*
	1½	Fed. 209	38.5/Blue Dot	Rem. RXP12	1315	9,500*
	1½	Fed. 209	37.5/Blue Dot	Win. WAA12	1315	10,000*
	1½	Fed. 209	38.0/Blue Dot	Activ TG30	1315	9,500*
	1⅜	Fed. 209	40.0/Blue Dot	Fed. 12S4	1350	9,500*
	1⅜	Fed. 209	40.0/Blue Dot	Rem. SP12	1350	9,000*
	1⅜	Fed. 209	40.0/Blue Dot	Win. WAA12F114	1350	10,000*
	1⅜	Fed. 209	30.5/Herco	Fed. 12S3	1295	10,000*
	1⅜	Fed. 209	30.5/Herco	Rem. RXP12	1295	9,300*
	1⅜	Fed. 209	30.5/Herco	Win. WAA12	1295	9,700*
Federal Plastic Unibody	1⅞	Fed. 209	36.5/Blue Dot	Rem. SP12	1155	10,000*
	1⅞	Fed. 209	35.5/Blue Dot	Activ T35	1155	9,500*
	1¾	Fed. 209	39.0/Blue Dot	Rem. RP12	1245	10,500*
Case	Shot Wgt. in Oz.	Primer	—Powder— Grains/Type	Wad	Velocity fps	Pressure LUP/psi*

12-Gauge – 3″ Shells

Case	Shot Wgt. in Oz.	Primer	—Powder— Grains/Type	Wad	Velocity fps	Pressure LUP/psi*
Federal Plastic Unibody (continued)	1⅝	Fed. 209	40.0/Blue Dot	Fed. 12S4	1280	10,000*
	1⅝	Fed. 209	40.0/Blue Dot	Rem. SP12	1280	9,500*
	1⅝	Fed. 209	40.0/Blue Dot	Win. WAA12F114	1280	10,000*
	1½	Fed. 209	40.0/Blue Dot	Fed. 12S4	1315	9,700*
	1½	Fed. 209	40.0/Blue Dot	Rem. SP12	1315	9,000*
	1½	Fed. 209	42.0/Blue Dot	Win. WAA12F114	1315	10,000*
	1⅜	Fed. 209	42.0/Blue Dot	Rem. RXP12	1350	8,000*
	1⅜	Fed. 209	44.0/Blue Dot	Win. WAA12	1350	10,000*
	1⅜	Fed. 209	40.5/Blue Dot	Fed. 12S3	1295	8,000*
	1⅜	Fed. 209	38.0/Blue Dot	Win. WAA12	1295	10,000*
	1⅜	Fed. 209	31.0/Herco	Fed. 12S3	1295	10,500*
	1⅜	Fed. 209	32.0/Herco	Rem. RXP12	1295	10,000*
Remington Plastic Unibody	1½	CCI 209M	37.5/Hercules 2400	Rem. SP12	1315	10,700*
	1⅜	Win. 209	38.5/Hercules 2400	Rem. RXP12	1350	10,000*
	1⅜	Win. 209	38.0/Hercules 2400	Fed. 12S4	1350	10,200*
	1⅜	Win. 209	38.0/Hercules 2400	Win. WAA12F114	1350	10,500*
	1⅜	Win. 209	38.5/Hercules 2400	Activ T32	1350	10,000*
	1⅜	Win. 209	37.0/Hercules 2400	Fed. 12S3	1295	9,500*
Case	Shot Wgt. in Oz.	Primer	—Powder— Grains/Type	Wad	Velocity fps	Pressure LUP/psi*

Case	Shot Wgt. in Oz.	Primer	—Powder— Grains/Type	Wad	Velocity fps	Pressure LUP/psi*
Remington Plastic Unibody (continued)	1⅜	Win. 209	35.5/Hercules 2400	Win. WAA12SL	1295	10,000*
	1⅜	Win. 209	36.5/Hercules 2400	Win. WAA12	1295	9,500*
	1⅜	Win. 209	36.5/Hercules 2400	Activ TG30	1295	9,000*
Remington Plastic Plastic Base Wad	1⅞	CCI 209M	34.0/Blue Dot	Rem. RP12	1155	10,500*
	1⅞	CCI 209M	34.0/Blue Dot	Activ T35	1155	10,000*
	1¾	CCI 209M	38.5/Blue Dot	Rem. RP12	1245	10,700*
	1¾	CCI 209M	37.5/Blue Dot	Activ T35	1245	10,500*
	1⅝	CCI 209M	39.0/Blue Dot	Rem. SP12	1280	10,000*
	1⅝	CCI 209M	38.5/Blue Dot	Fed. 12S4	1280	10,200*
	1⅝	CCI 209M	38.5/Blue Dot	Win. WAA12F114	1280	10,500*
	1⅜	CCI 209M	42.5/Blue Dot	Rem. RXP12	1350	8,000*
	1⅜	CCI 209M	42.0/Blue Dot	Fed. 12S3	1350	8,500*
	1⅜	CCI 209M	42.0/Blue Dot	Win. WAA12	1350	8,500*
	1⅜	CCI 209M	29.5/Herco	Fed. 12S3	1295	10,000*
Winchester Plastic Compression Formed	1⅞	Win. 209	33.0/571	Win. WAA12R	1155	10,500
	1⅞	Win. 209	34.0/571	Rem. RP12	1155	10,000
	1¾	Win. 209	45.0/Hercules 2400	Rem. RP12	1245	10,000*
	1¾	CCI 209	31.0/SR 4756	Win. WAA12R	1135	10,500
	1¾	CCI 209	31.0/SR 4756	Rem. RP12	1135	10,000
Case	Shot Wgt. in Oz.	Primer	—Powder— Grains/Type	Wad	Velocity fps	Pressure LUP/psi*

Heavy Field

12-Gauge — 3″ Shells

Case	Shot Wgt. in Oz.	Primer	—Powder— Grains/Type	Wad	Velocity fps	Pressure LUP/psi*
Winchester Plastic Compression Formed (continued)	1⅝	Win. 209	50.0/Hercules 2400	Rem. RP12	1335	10,000*
	1⅝	Win. 209	36.0/571	Win. WAA12	1195	10,500
	1⅝	Win. 209	36.0/571	Rem. R12H	1195	10,100
	1⅝	Fed. 209	32.0/SR 4756	Win. WAA12R	1195	10,500
	1⅝	Win. 209	32.0/SR 4756	Rem. RP12	1195	10,500
	1½	Win. 209	38.5/Blue Dot	Rem. SP12	1315	10,500*
	1½	Fed. 209	33.0/SR 4756	Win. WAA12	1265	10,700
	1½	Fed. 209	34.0/SR 4756	Rem. SP12	1295	11,000
	1½	Win. 209	29.0/SR7625	Win. WAA12F114	1205	10,200
	1½	Win. 209	29.0/SR 7625	Rem. SP12	1205	10,000
	1⅜	Fed. 209	36.0/SR 4756	Win. WAA12F114	1380	11,000
	1⅜	Fed. 209	36.0/SR 4756	Rem. SP12	1380	10,500
	1⅜	Win. 209	40.0/Blue Dot	Fed. 12S4	1350	10,500*
	1⅜	Win. 209	40.5/Blue Dot	Rem. SP12	1350	9,500*
	1⅜	Win. 209	39.0/Blue Dot	Win. WAA12F114	1350	10,000*
	1⅜	Fed. 209	31.0/SR 7625	Rem. RXP12	1315	10,700
	1⅜	Win. 209	37.5/Blue Dot	Fed. 12S3	1295	10,500*
	1⅜	Win. 209	38.0/Blue Dot	Rem. RXP12	1295	9,500*
Case	Shot Wgt. in Oz.	Primer	—Powder— Grains/Type	Wad	Velocity fps	Pressure LUP/psi*

Case	Shot Wgt. in Oz.	Primer	—Powder— Grains/Type	Wad	Velocity fps	Pressure LUP/psi*
Winchester Plastic Compression Formed (continued)	1⅜	Win. 209	37.5/Blue Dot	Win. WAA12	1295	10,000*
	1⅜	Win. 209	35.0/540	Win. WAA12	1295	9,500
	1⅜	Win. 209	35.5/540	Rem. R12L	1295	9,500
	1⅜	Win. 209	31.0/SR 7625	Win. WAA12	1295	10,000
	1⅜	Fed. 209	29.0/SR7625	Fed. 12S4	1265	11,000
	1¼	Fed. 209	33.0/SR 7625	Win. WAA12	1410	10,500
	1¼	Fed. 209	32.0/SR 7625	Rem. RXP12	1385	10,500
	1¼	Win. 209	29.0/PB	Win. WAA12	1330	10,000
	1¼	Win. 209	28.0/PB	Rem. RXP12	1300	10,000
Activ One-Piece Plastic	2	CCI 209M	35.0/Blue Dot	Rem. RP12	1120	10,500*
	1⅞	CCI 209M	36.5/Blue Dot	Activ T35	1155	10,000*
	1⅞	CCI 209M	37.0/Blue Dot	Rem. SP12	1155	10,000*
	1¾	CCI 209M	40.0/Blue Dot	Activ T35	1245	10,500*
	1¾	CCI 209M	40.0/Blue Dot	Rem. SP12	1245	10,700*
	1⅝	CCI 209M	39.0/Blue Dot	Activ T35	1280	10,000*
	1⅝	CCI 209M	39.5/Blue Dot	Fed. 12S4	1280	10,500*
	1⅝	CCI 209M	41.5/Blue Dot	Rem. SP12	1280	10,000*
	1⅝	CCI 209M	40.0/Blue Dot	Win. WAA12F114	1280	10,000*
	1½	CCI 209M	41.0/Blue Dot	Activ T35	1315	9,500*
	1½	CCI 209M	40.5/Blue Dot	Fed. 12S4	1315	9,200*
Case	Shot Wgt. in Oz.	Primer	—Powder— Grains/Type	Wad	Velocity fps	Pressure LUP/psi*

12-Gauge — 3″ Shells

Case	Shot Wgt. in Oz.	Primer	—Powder— Grains/Type	Wad	Velocity fps	Pressure LUP/psi*
Activ One-Piece Plastic (continued)	1½	CCI 209M	41.5/Blue Dot	Rem. R12H	1315	8,500*
	1½	CCI 209M	40.0/Blue Dot	Win. WAA12F114	1315	10,000*
	1⅜	CCI 209M	43.0/Blue Dot	Activ T32	1350	8,500*
	1⅜	CCI 209M	42.5/Blue Dot	Rem. RXP12	1350	8,000*
	1⅜	CCI 209M	40.5/Blue Dot	Win. WAA12	1350	8,500*
	1⅜	CCI 209M	41.5/Blue Dot	Fed. 12S3	1350	8,500*
	1⅜	CCI 209M	33.5/Herco	Activ T32	1350	10,700*
	1⅜	CCI 209M	33.0/Herco	Rem. RXP12	1350	10,500*
	1⅜	CCI 209M	31.5/Herco	Fed. 12S3	1295	10,500*
	1⅜	CCI 209M	31.5/Herco	Rem. RXP12	1295	10,000*
	1⅜	CCI 209M	31.5/Herco	Win. WAA12	1295	10,000*
Fiocchi Plastic	1⅞	Fio. 616	34.5/Blue Dot	Rem. RP12	1155	10,700*
	1⅞	Fio. 616	34.5/Blue Dot	Activ T35	1155	10,500*
	1¾	Fio. 616	37.5/Blue Dot	Activ T35	1245	10,500*
	1⅝	Fio. 616	39.0/Blue Dot	Fed. 12S4	1280	10,700*
	1⅝	Fio. 616	39.5/Blue Dot	Rem. SP12	1280	9,700*
	1⅝	Fio. 616	38.5/Blue Dot	Win. WAA12F114	1280	10,500*
	1⅝	Fio. 616	39.0/Blue Dot	Activ T35	1280	10,500*
Case	Shot Wgt. in Oz.	Primer	—Powder— Grains/Type	Wad	Velocity fps	Pressure LUP/psi*

Case	Shot Wgt. in Oz.	Primer	—Powder— Grains/Type	Wad	Velocity fps	Pressure LUP/psi*
Fiocchi Plastic (continued)	1½	CCI 209M	38.0/Blue Dot	Fed. 12S4	1315	10,500*
	1½	Win. 209	39.0/Blue Dot	Fed 12S4	1315	10,500*
	1½	Fio. 616	39.0/Blue Dot	Fed. 12S4	1315	10,500*
	1½	Fio. 616	39.0/Blue Dot	Rem. SP12	1315	9,700*
	1½	Fio. 616	39.0/Blue Dot	Win. WAA12F114	1315	9,500*
	1½	Fio. 616	39.0/Blue Dot	Activ T35	1315	9,000*
	1⅜	CCI 209M	38.0/Blue Dot	Fed. 12S4	1350	10,500*
	1⅜	Win. 209	38.5/Blue Dot	Fed. 12S4	1350	10,000*
	1⅜	Fio. 616	32.0/Herco	Fed. 12S4	1350	10,700*
	1⅜	Fio. 616	32.5/Herco	Rem. SP12	1350	10,000*
	1⅜	Fio. 616	32.5/Herco	Win. WAA12F114	1350	10,700*
	1⅜	Fio. 616	32.5/Herco	Activ T32	1350	10,500*
	1⅜	CCI 209M	37.0/Blue Dot	Fed. 12S3	1295	9,000*
	1⅜	CCI 209M	30.0/Herco	Fed. 12S3	1295	10,000*
	1⅜	Win. 209	37.5/Blue Dot	Fed. 12S3	1295	9,000*
	1⅜	Win. 209	29.5/Herco	Fed. 12S3	1295	10,500*
	1⅜	Fio. 616	31.5/Herco	Fed. 12S3	1295	9,000*
	1⅜	Fio. 616	32.5/Herco	Rem. RXP12	1295	8,500*
	1⅜	Fio. 616	31.5/Herco	Win. WAA12	1295	9,000*
	1⅜	Fio. 616	31.0/Herco	Fio. FTW1	1295	9,200*

| Case | Shot Wgt. in Oz. | Primer | —Powder— Grains/Type | Wad | Velocity fps | Pressure LUP/psi* |

12-Gauge – 2¾″ Shells

Case	Shot Wgt. in Oz.	Primer	—Powder— Grains/Type	Wad	Velocity fps	Pressure LUP/psi*
Federal Paper Target	1½	Fed. 209	34.0/Blue Dot	Rem. RP12	1205	9,500*
	1½	Rem. 209P	34.5/Blue Dot	Rem. RP12	1205	10,500*
	1½	Win. 209	35.0/Blue Dot	Rem. RP12	1205	9,500*
	1½	CCI 209M	35.0/Blue Dot	Rem. RP12	1205	9,500*
	1½	Fed. 209	25.0/Herco	Rem. SP12	1150	10,200*
	1½	Fed. 209	31.5/Blue Dot	Activ T42	1150	9,000*
	1½	Fed. 209	32.5/Blue Dot	Rem. RP12	1150	9,000*
	1½	Win. 209	31.5/Blue Dot	Activ T42	1150	9,500*
	1½	Rem. 209P	32.5/Blue Dot	Activ T42	1150	9,000*
	1½	CCI 209M	33.0/Blue Dot	Activ T42	1150	9,500*
	1½	Fio. 616	32.0/Blue Dot	Activ T42	1150	9,500*
	1⅜	Fed. 209	37.5/Blue Dot	Rem. RP12	1350	10,700*
	1⅜	Fed. 209	36.0/SR 4756	Rem. RP12	1350	11,000
	1⅜	Fed. 209	36.0/SR 4756	Win. WAA12R	1350	10,700
	1⅜	Fed. 209	31.0/SR 7625	Win. WAA12R	1315	10,500
	1⅜	Fed. 209	30.0/SR 7625	Rem. RP12	1295	11,000
	1⅜	CCI 209M	37.0/Blue Dot	Rem. SP12	1295	10,500*
	1⅜	Win. 209	36.5/Blue Dot	Rem. SP12	1295	10,200*
Case	Shot Wgt. in Oz.	Primer	—Powder— Grains/Type	Wad	Velocity fps	Pressure LUP/psi*

Case	Shot Wgt. in Oz.	Primer	—Powder— Grains/Type	Wad	Velocity fps	Pressure LUP/psi*
Federal Paper Target (continued)	1⅜	Rem. 209P	38.0/Blue Dot	Rem. SP12	1295	8,500*
	1⅜	Fed. 209	36.5/Blue Dot	Win. WAA12F114	1295	10,500*
	1⅜	Fed. 209	35.5/Blue Dot	Rem. SP12	1295	10,500*
	1⅜	CCI 209M	34.5/Blue Dot	Rem. SP12	1240	9,500*
	1⅜	Win. 209	34.5/Blue Dot	Rem. SP12	1240	9,500*
	1⅜	Rem. 209P	36.0/Blue Dot	Rem. SP12	1240	8,500*
	1⅜	Fed. 209	34.0/Blue Dot	Rem. SP12	1240	10,000*
	1⅜	Fed. 209	33.0/Blue Dot	Win. WAA12F114	1240	10,200*
	1¼	Fed. 209	37.0/Blue Dot	Fed. 12S4	1330	10,500*
	1¼	Fed. 209	29.0/Herco	Rem. RP12	1330	9,500*
	1¼	Fed. 209	29.5/Herco	Rem. SP12	1330	9,500*
	1¼	Fed. 209	29.5/Herco	Win. WAA12F114	1330	9,200*
	1¼	Win. 209	37.5/Blue Dot	Fed. 12S4	1330	10,500*
	1¼	CCI 209M	28.0/Unique	Fed. 12S4	1330	10,700*
	1¼	CCI 209M	29.5/Herco	Fed. 12S4	1330	10,000*
	1¼	CCI 209M	37.0/Blue Dot	Fed. 12S4	1330	9,000*
	1¼	Win. 209	35.5/SR 4756	Win. WAA12R	1330	8,000
	1¼	Fed. 209	34.0/SR 4756	Rem. RP12	1330	8,500
	1¼	Fed. 209	35.0/SR 4756	Win. WAA12R	1330	8,000
Case	Shot Wgt. in Oz.	Primer	—Powder— Grains/Type	Wad	Velocity fps	Pressure LUP/psi*

12-Gauge — 2¾″ Shells

Case	Shot Wgt. in Oz.	Primer	—Powder— Grains/Type	Wad	Velocity fps	Pressure LUP/psi*
Federal Paper Target (continued)	1¼	Win. 209	34.5/SR 4756	Rem. RP12	1330	8,000
	1¼	Win. 209	31.0/SR 7625	Rem. RP12	1330	9,000
	1¼	Win. 209	31.5/SR 7625	Win. WAA12R	1330	8,200
Federal Plastic Gold Medal	1½	Fed. 209	34.0/Blue Dot	Rem. RP12	1205	9,700*
	1½	Rem. 209P	35.5/Blue Dot	Rem. RP12	1205	8,000*
	1½	CCI 209M	34.0/Blue Dot	Rem. RP12	1205	9,500*
	1½	Win. 209	34.5/Blue Dot	Rem. RP12	1205	10,000*
	1½	Fed. 209	25.5/Herco	Rem. RP12	1150	10,000*
	1½	Fed. 209	33.5/Blue Dot	Rem. RP12	1150	8,500*
	1½	Win. 209	32.5/Blue Dot	Activ T42	1150	9,200*
	1½	Rem. 209P	32.5/Blue Dot	Activ T42	1150	9,500*
	1½	CCI 209M	32.5/Blue Dot	Activ T42	1150	9,500*
	1½	Fio. 616	32.0/Blue Dot	Activ T42	1150	9,700*
	1⅜	Fed. 209	34.0/SR 4756	Rem. RP12	1340	10,000
	1⅜	Fed. 209	34.0/SR 4756	Win. WAA12R	1315	8,500
	1⅜	Fed. 209	31.5/SR 7625	Rem. RP12	1315	10,000
	1⅜	Fed. 209	31.5/SR 7625	Win. WAA12R	1315	9,300
	1⅜	Fed. 209	35.5/Blue Dot	Rem. RP12	1295	10,700*
Case	Shot Wgt. in Oz.	Primer	—Powder— Grains/Type	Wad	Velocity fps	Pressure LUP/psi*

Case	Shot Wgt. in Oz.	Primer	—Powder— Grains/Type	Wad	Velocity fps	Pressure LUP/psi*
Federal Plastic Gold Medal (continued)	1⅜	Rem. 209P	39.0/Blue Dot	Rem. RP12	1295	8,500*
	1⅜	Win. 209	36.0/Blue Dot	Rem. RP12	1295	9,200*
	1⅜	CCI 209M	36.5/Blue Dot	Rem. RP12	1295	9,000*
	1⅜	Fed. 209	34.0/Blue Dot	Rem. RP12	1240	10,000*
	1⅜	Fed. 209	33.0/Blue Dot	Win. WAA12F114	1240	10,000*
	1⅜	Win. 209	34.5/Blue Dot	Rem. RP12	1240	8,500*
	1⅜	CCI 209M	35.0/Blue Dot	Rem. RP12	1240	8,500*
	1⅜	Rem. 209P	36.0/Blue Dot	Rem. RP12	1240	8,000*
	1¼	Fed. 209	35.0/Blue Dot	Rem. SP12	1330	10,500*
	1¼	Win. 209	37.0/Blue Dot	Rem. SP12	1330	9,000*
	1¼	CCI 209M	37.5/Blue Dot	Rem. SP12	1330	8,500*
	1¼	Fed. 209	29.0/PB	Rem. SP12	1330	10,200
	1¼	Win. 209	29.0/PB	Rem. SP12	1330	10,500
	1¼	Win. 209	31.5/WSF	Fed. 12S4	1330	9,500*
	1¼	CCI 209	29.5/WSF	Fed. 12S4	1330	10,500*
Federal Plastic Hi Power Paper Base Wad	1½	Fed. 209	36.0/Blue Dot	Rem. RP12	1260	9,500*
	1½	Fed. 209	37.0/Blue Dot	Rem. SP12	1260	9,500*
	1½	Win. 209	37.0/Blue Dot	Rem. RP12	1260	10,000*
	1½	CCI 209M	37.0/Blue Dot	Rem. RP12	1260	9,500*

Case | Shot Wgt. in Oz. | Primer | —Powder— Grains/Type | Wad | Velocity fps | Pressure LUP/psi*

12-Gauge – 2¾″ Shells

Case	Shot Wgt. in Oz.	Primer	—Powder— Grains/Type	Wad	Velocity fps	Pressure LUP/psi*
Federal Plastic Hi Power Paper Base Wad (continued)	1½	Fed. 209	34.5/Blue Dot	Rem. RP12	1205	8,500*
	1½	CCI 209M	35.0/Blue Dot	Rem. RP12	1205	8,700*
	1½	Win. 209	34.5/Blue Dot	Rem. RP12	1205	8,500*
	1½	Fed. 209	26.5/Herco	Rem. SP12	1150	9,000*
	1½	Fed. 209	32.5/Blue Dot	Activ T42	1150	9,000*
	1½	Fed. 209	33.5/Blue Dot	Rem. RP12	1150	8,500*
	1½	Win. 209	32.5/Blue Dot	Activ T42	1150	9,500*
	1½	Rem. 209P	33.0/Blue Dot	Activ T42	1150	9,000*
	1½	CCI 209M	33.5/Blue Dot	Activ T42	1150	8,000*
	1½	Fio. 616	32.5/Blue Dot	Activ T42	1150	9,500*
	1⅜	Win. 209	40.0/Blue Dot	Rem. RP12	1350	9,500*
	1⅜	CCI 209M	39.5/Blue Dot	Rem. RP12	1350	9,500*
	1⅜	Fed. 209	38.5/Blue Dot	Rem. RP12	1295	8,500*
	1⅜	Fed. 209	38.0/Blue Dot	Rem. SP12	1295	9,000*
	1⅜	Fed. 209	37.5/Blue Dot	Win. WAA12R	1295	8,500*
	1⅜	Fed. 209	37.5/Blue Dot	Win. WAA12F114	1295	9,000*
	1⅜	Rem. 209P	39.0/Blue Dot	Rem. RP12	1295	8,500*
	1⅜	Win. 209	39.0/Blue Dot	Rem. RP12	1295	9,500*
Case	Shot Wgt. in Oz.	Primer	—Powder— Grains/Type	Wad	Velocity fps	Pressure LUP/psi*

Case	Shot Wgt. in Oz.	Primer	—Powder— Grains/Type	Wad	Velocity fps	Pressure LUP/psi*
Federal Plastic Hi Power Paper Base Wad (continued)	1⅜	CCI 209M	39.0/Blue Dot	Rem. RP12	1295	8,500*
	1¼	Fed. 209	25.5/Unique	Fed. 12C1	1330	10,200*
	1¼	Fed. 209	28.5/Herco	Fed. 12C1	1330	10,000*
	1¼	Fed. 209	29.0/Herco	Fed. 12S4	1330	10,000*
	1¼	Fed. 209	25.5/Unique	Rem. SP12	1330	10,000*
	1¼	Fed. 209	28.5/Herco	Rem. SP12	1330	10,000*
	1¼	Fed. 209	29.0/Herco	Win. WAA12R	1330	10,500*
	1¼	Fed. 209	29.5/Herco	Win. WAA12F114	1330	9,500*
	1¼	Win. 209	30.0/Herco	Fed. 12S4	1330	10,200*
	1¼	Win. 209	38.0/Blue Dot	Fed. 12S4	1330	8,500*
	1¼	CCI 209M	30.0/Herco	Fed. 12S4	1330	9,500*
	1¼	CCI 209M	38.0/Blue Dot	Fed. 12S4	1330	10,000*
Federal Plastic Unibody	1⅝	Fed. 209	26.5/Herco	Rem. SP12	1115	10,000*
	1⅝	Win. 209	26.5/Herco	Rem. SP12	1115	10,000*
	1⅝	Rem. 209P	26.5/Herco	Rem. SP12	1115	9,500*
	1⅝	CCI 209M	26.5/Herco	Rem. SP12	1115	10,000*
	1⅝	Fio. 616	26.0/Herco	Rem. SP12	1115	10,500*
	1½	Win. 209	38.0/Blue Dot	Rem. RP12	1260	9,000*
	1½	CCI 209M	38.0/Blue Dot	Rem. RP12	1260	10,000*
Case	Shot Wgt. in Oz.	Primer	—Powder— Grains/Type	Wad	Velocity fps	Pressure LUP/psi*

12-Gauge — 2¾″ Shells

Case	Shot Wgt. in Oz.	Primer	—Powder— Grains/Type	Wad	Velocity fps	Pressure LUP/psi*
Federal Plastic Unibody (continued)	1½	Fed. 209	36.0/Blue Dot	Rem. RP12	1205	9,000*
	1½	Win. 209	37.0/Blue Dot	Rem. RP12	1205	8,500*
	1½	CCI 209M	36.0/Blue Dot	Rem. RP12	1205	8,500*
	1½	Fed. 209	27.0/Herco	Fed. 12S4	1150	9,200*
	1½	Fed. 209	27.0/Herco	Rem. SP12	1150	8,500*
	1½	Fed. 209	26.5/Herco	Win. WAA12F114	1150	8,700*
	1½	Fed. 209	26.5/Herco	Activ T35	1150	8,500*
	1½	Win. 209	26.5/Herco	Fed. 12S4	1150	10,000*
	1½	Rem. 209P	26.5/Herco	Fed. 12S4	1150	10,000*
	1½	CCI 209M	26.5/Herco	Fed. 12S4	1150	10,000*
	1½	Fio. 616	26.0/Herco	Fed. 12S4	1150	10,000*
	1⅜	Fed. 209	38.5/Blue Dot	Rem. RP12	1295	8,700*
	1⅜	Win. 209	38.5/Blue Dot	Rem. RP12	1295	9,500*
	1⅜	CCI 209M	38.0/Blue Dot	Rem. RP12	1295	9,000*
	1⅜	Fed. 209	37.0/Blue Dot	Rem. SP12	1240	8,000*
	1⅜	Fed. 209	38.0/Blue Dot	Win. WAA12F114	1240	8,000*
	1⅜	CCI 209M	37.5/Blue Dot	Rem. SP12	1240	8,500*
	1¼	Fed. 209	38.5/Blue Dot	Fed. 12S4	1330	8,500*
Case	Shot Wgt. in Oz.	Primer	—Powder— Grains/Type	Wad	Velocity fps	Pressure LUP/psi*

Case	Shot Wgt. in Oz.	Primer	—Powder— Grains/Type	Wad	Velocity fps	Pressure LUP/psi*
Federal Plastic Unibody (continued)	1¼	Win. 209	39.0/Blue Dot	Fed. 12S4	1330	8,500*
	1¼	CCI 209M	37.5/Blue Dot	Fed. 12S4	1330	9,000*
Remington Plastic Premier Target	1½	Rem. 209P	33.0/Blue Dot	Rem. RP12	1205	10,200*
	1½	Rem. 209P	31.5/Blue Dot	Activ T42	1205	10,500*
	1½	Fed. 209	33.0/Blue Dot	Rem. RP12	1205	10,500*
	1½	Win. 209	33.0/Blue Dot	Rem. RP12	1205	10,200*
	1½	CCI 209M	33.0/Blue Dot	Rem. RP12	1205	10,000*
	1½	Fio. 616	33.0/Blue Dot	Rem. RP12	1205	10,000*
	1½	Rem. 209P	31.0/Blue Dot	Rem. RP12	1150	10,000*
	1½	Rem. 209P	30.5/Blue Dot	Activ T42	1150	10,500*
	1½	Fed. 209	31.0/Blue Dot	Rem. RP12	1150	10,000*
	1½	Win. 209	31.5/Blue Dot	Rem. RP12	1150	10,000*
	1½	CCI 209M	31.0/Blue Dot	Rem. RP12	1150	10,000*
	1½	Fio. 616	31.0/Blue Dot	Rem. RP12	1150	10,000*
	1⅜	Rem. 209P	37.5/Blue Dot	Rem. SP12	1295	10,500*
	1⅜	Rem. 209P	36.5/Blue Dot	Rem. RP12	1295	10,000*
	1⅜	Fed. 209	35.5/Blue Dot	Rem. RP12	1295	10,500*
	1⅜	Win. 209	35.5/Blue Dot	Rem. RP12	1295	10,500*
	1⅜	CCI 209M	35.5/Blue Dot	Rem. RP12	1295	10,500*
Case	Shot Wgt. in Oz.	Primer	—Powder— Grains/Type	Wad	Velocity fps	Pressure LUP/psi*

12-Gauge — 2¾″ Shells

Case	Shot Wgt. in Oz.	Primer	—Powder— Grains/Type	Wad	Velocity fps	Pressure LUP/psi*
Remington Plastic Premier Target (continued)	1⅜	Fio. 616	35.5/Blue Dot	Rem. RP12	1295	10,000*
	1⅜	Rem. 209P	35.0/Blue Dot	Rem. SP12	1240	9,500*
	1⅜	Rem. 209P	34.0/Blue Dot	Activ T35	1240	9,500*
	1⅜	Win. 209	35.0/Blue Dot	Rem. SP12	1240	9,000*
	1⅜	Fed. 209	34.0/Blue Dot	Rem. SP12	1240	9,000*
	1⅜	CCI 209M	34.0/Blue Dot	Rem. SP12	1240	9,500*
	1⅜	Fio. 616	34.0/Blue Dot	Rem. SP12	1240	9,000*
	1¼	Rem. 209P	37.5/Blue Dot	Rem. SP12	1330	9,500*
	1¼	Fed. 209	36.5/Blue Dot	Rem. SP12	1330	9,500*
	1¼	Win. 209	36.5/Blue Dot	Rem. SP12	1330	10,000*
	1¼	CCI 209M	35.5/Blue Dot	Rem. SP12	1330	10,500*
	1¼	Fio. 616	35.5/Blue Dot	Rem. SP12	1330	10,000*
Remington Plastic Unibody SP	1⅝	Rem. 209P	29.5/Blue Dot	Activ T42	1115	10,500*
	1⅝	Fed. 209	29.0/Blue Dot	Activ T42	1115	10,500*
	1⅝	Win. 209	29.5/Blue Dot	Activ T42	1115	10,500*
	1⅝	CCI 209M	29.5/Blue Dot	Activ T42	1115	10,500*
	1⅝	Fio. 616	29.5/Blue Dot	Activ T42	1115	10,500*
	1½	Rem. 209P	32.5/Blue Dot	Rem. RP12	1150	8,000*
Case	Shot Wgt. in Oz.	Primer	—Powder— Grains/Type	Wad	Velocity fps	Pressure LUP/psi*

Case	Shot Wgt. in Oz.	Primer	—Powder— Grains/Type	Wad	Velocity fps	Pressure LUP/psi*
Remington Plastic Unibody SP (continued)	1½	Rem. 209P	31.5/Blue Dot	Activ T42	1150	9,500*
	1½	Fed. 209	31.5/Blue Dot	Rem. RP12	1150	9,000*
	1½	Win. 209	32.0/Blue Dot	Rem. RP12	1150	8,500*
	1½	CCI 209M	32.0/Blue Dot	Rem. RP12	1150	8,500*
	1½	Fio. 616	31.5/Blue Dot	Rem. RP12	1150	9,200*
	1⅜	CCI 209	36.0/Blue Dot	Rem. RP12	1240	10,000*
	1⅜	CCI 209M	32.5/Blue Dot	Rem. RP12	1240	10,500*
	1¼	CCI 209	37.5/Blue Dot	Rem. RP12	1330	9,700*
	1¼	CCI 209M	35.5/Blue Dot	Rem. RP12	1330	10,500*
Winchester Plastic AA Compression Formed	1½	Win. 209	36.5/571	Win. WAA12R	1260	10,500
	1½	Win. 209	36.5/571	Rem. RP12	1260	10,000
	1½	CCI 109	35.5/571	Win. WAA12R	1260	10,500
	1½	Win. 209	31.0/Blue Dot	Rem. RP12	1150	9,500*
	1½	Win. 209	30.0/Blue Dot	Activ T42	1150	10,000*
	1½	Rem. 209P	30.0/Blue Dot	Activ T42	1150	10,500*
	1½	CCI 209M	30.0/Blue Dot	Activ T42	1150	10,500*
	1½	Win. 209	27.5/540	Win. WAA12R	1095	8,500
	1½	Win. 209	27.5/540	Rem. RP12	1095	8,700
	1½	Fed. 209	27.0/540	Win. WAA12R	1095	9,700
Case	Shot Wgt. in Oz.	Primer	—Powder— Grains/Type	Wad	Velocity fps	Pressure LUP/psi*

12-Gauge — 2¾″ Shells

Case	Shot Wgt. in Oz.	Primer	—Powder— Grains/Type	Wad	Velocity fps	Pressure LUP/psi*
Winchester Plastic AA Compression Formed (continued)	1½	Fed. 209	26.5/540	Rem. RP12	1095	9,500
	1⅜	Win. 209	32.0/540	Win. WAA12F114	1280	10,500
	1⅜	Win. 209	36.0/571	Win. WAA12F114	1280	10,500
	1⅜	Fed. 209	35.5/571	Win. WAA12R	1280	10,500
	1⅜	Fed. 209	35.5/571	Rem. RP12	1280	10,000
	1⅜	Win. 209	32.5/SR 4756	Win. WAA12R	1280	10,000
	1⅜	Win. 209	32.0/SR 4756	Rem. RP12	1280	10,500
	1⅜	Fed. 209	32.5/SR 4756	Win. WAA12R	1280	10,500
	1⅜	Fed. 209	32.0/SR 4756	Rem. RP12	1280	10,700
	1⅜	Win. 209	26.0/Hi-Skor 800-X	Rem. SP12	1240	10,500
	1⅜	Win. 209	26.0/Hi-Skor 800-X	Win. WAA12R	1240	10,500
	1⅜	Win. 209	34.0/Blue Dot	Win. WAA12F114	1240	10,500*
	1⅜	Win. 209	33.0/Blue Dot	Rem. SP12	1240	10,500*
	1⅜	Win. 209	33.0/Blue Dot	Fed. 12S4	1240	10,500*
	1⅜	Fed. 209	32.0/Blue Dot	Win. WAA12F114	1240	10,000*
	1⅜	CCI 209M	33.5/Blue Dot	Win. WAA12F114	1240	8,500*
	1¼	Win. 209	38.0/Blue Dot	Rem. RP12	1330	10,000*
	1¼	Win. 209	37.0/Blue Dot	Rem. SP12	1330	10,500*

| Case | Shot Wgt. in Oz. | Primer | —Powder— Grains/Type | Wad | Velocity fps | Pressure LUP/psi* |

BLUE DOT
SP
RP12

Case	Shot Wgt. in Oz.	Primer	—Powder— Grains/Type	Wad	Velocity fps	Pressure LUP/psi*
Winchester Plastic AA Compression Formed (continued)	1¼	Win. 209	37.0/Blue Dot	Win. WAA12F114	1330	10,500*
	1¼	Win. 209	36.5/Blue Dot	Activ T35	1330	9,500*
	1¼	Fed. 209	33.5/Blue Dot	Win. WAA12F114	1330	10,500*
	1¼	CCI 209M	36.5/Blue Dot	Win. WAA12F114	1330	9,500*
	1¼	Win. 209	29.5/WSF	Win. WAA12F114	1330	10,500
	1¼	CCI 209	28.0/WSF	Rem. SP12	1330	10,000
	1¼	Win. 209	34.5/540	Win. WAA12	1330	10,000
	1¼	Win. 209	33.0/540	Win. WAA12F114	1330	10,500
	1¼	Win. 209	35.0/540	Rem. R12H	1330	10,500
	1¼	Win. 209	35.0/540	Fed. 12C1	1330	10,200
	1¼	CCI 109	34.5/540	Win. WAA12	1330	10,500
Activ Plastic	1⅝	CCI 209M	31.5/Blue Dot	Activ T42	1115	9,600*
	1⅝	Fed. 209	31.0/Blue Dot	Activ T42	1115	9,200*
	1⅝	Win. 209	31.5/Blue Dot	Activ T42	1115	9,500*
	1⅝	Rem. 209P	31.5/Blue Dot	Activ T42	1115	9,500*
	1⅝	Fio. 616	31.0/Blue Dot	Activ T42	1115	9,500*
	1½	CCI 209	38.5/Blue Dot	Activ T42	1260	9,500*
	1½	CCI 209M	36.5/Blue Dot	Activ T42	1260	10,200*
	1½	CCI 209M	35.5/Blue Dot	Rem. RP12	1260	10,000*
	1½	Win. 209	36.0/Blue Dot	Activ T42	1260	10,500*

Case | Shot Wgt. in Oz. | Primer | —Powder— Grains/Type | Wad | Velocity fps | Pressure LUP/psi*

12-Gauge — 2¾″ Shells

Case	Shot Wgt. in Oz.	Primer	—Powder— Grains/Type	Wad	Velocity fps	Pressure LUP/psi*
Activ Plastic (continued)	1½	Win. 209	35.5/Blue Dot	Rem. RP12	1260	10,000*
	1½	CCI 209M	34.0/Blue Dot	Activ T42	1150	9,000*
	1½	Fed. 209	32.5/Blue Dot	Activ T42	1150	8,500*
	1½	Rem. 209P	34.0/Blue Dot	Activ T42	1150	8,200*
	1½	Win. 209	33.0/Blue Dot	Activ T42	1150	9,200*
	1½	Fio. 616	33.5/Blue Dot	Activ T42	1150	9,000*
	1⅜	Fed. 209	40.0/Blue Dot	Activ T35	1350	10,000*
	1⅜	Win. 209	39.5/Blue Dot	Activ T35	1350	10,000*
	1⅜	CCI 209	30.5/Herco	Activ T35	1295	10,500*
	1⅜	CCI 209	40.0/Blue Dot	Rem. RP12	1295	8,500*
	1⅜	CCI 209M	29.5/Herco	Activ T35	1295	10,500*
	1⅜	CCI 209M	38.5/Blue Dot	Activ T35	1295	8,500*
	1⅜	CCI 209M	38.0/Blue Dot	Rem. RP12	1295	9,500*
	1⅜	Fed. 209	38.0/Blue Dot	Activ T35	1295	9,700*
	1⅜	Fed. 209	37.0/Blue Dot	Rem. RP12	1295	10,200*
	1⅜	Win. 209	39.0/Blue Dot	Activ T35	1295	9,000*
	1⅜	Win. 209	38.0/Blue Dot	Rem. RP12	1295	9,500*
	1¼	CCI 209	30.5/Herco	Fed. 12S4	1330	9,800*
Case	Shot Wgt. in Oz.	Primer	—Powder— Grains/Type	Wad	Velocity fps	Pressure LUP/psi*

Case	Shot Wgt. in Oz.	Primer	—Powder— Grains/Type	Wad	Velocity fps	Pressure LUP/psi*
Activ Plastic (continued)	1¼	CCI 209	39.5/Blue Dot	Fed. 12S4	1330	9,500*
	1¼	CCI 209M	29.0/Herco	Activ T32	1330	10,200*
	1¼	Fed. 209	27.5/Unique	Activ T32	1330	10,500*
	1¼	Fed. 209	29.5/Herco	Activ T32	1330	10,500*
	1¼	Fed. 209	37.0/Blue Dot	Fed.12S4	1330	10,000*
	1¼	Win. 209	27.5/Unique	Activ T32	1330	10,200*
	1¼	Win. 209	29.0/Herco	Activ T32	1330	9,700*
	1¼	Win. 209	39.5/Blue Dot	Fed. 12S4	1330	9,000*
	1¼	Win. 209	28.5/Herco	Rem. SP12	1330	10,000*
	1¼	Win. 209	39.0/Blue Dot	Rem. SP12	1330	8,700*
	1¼	Win. 209	28.5/Herco	Win. WAA12F114	1330	10,500*
	1¼	Win. 209	40.0/Blue Dot	Win. WAA12F114	1330	9,000*
Fiocchi Plastic	1⅝	Fio. 616	31.0/Blue Dot	Activ T42	1115	9,500*
	1⅝	Fed. 209	31.0/Blue Dot	Activ T42	1115	9,500*
	1⅝	Win. 209	31.0/Blue Dot	Activ T42	1115	9,000*
	1⅝	CCI 209M	31.5/Blue Dot	Activ T42	1115	9,000*
	1½	Fio. 616	37.5/Blue Dot	Rem. RP12	1260	9,500*
	1½	CCI 209M	36.5/Blue Dot	Rem. RP12	1260	10,500*
	1½	Win. 209	36.5/Blue Dot	Rem. RP12	1260	10,500*
	1½	Fio. 616	36.5/Blue Dot	Rem. RP12	1205	9,000*
Case	Shot Wgt. in Oz.	Primer	—Powder— Grains/Type	Wad	Velocity fps	Pressure LUP/psi*

12-Gauge — 2¾″ Shells

Case	Shot Wgt. in Oz.	Primer	—Powder— Grains/Type	Wad	Velocity fps	Pressure LUP/psi*
Fiocchi Plastic (continued)	1½	Fed. 209	34.5/Blue Dot	Rem. RP12	1205	8,500*
	1½	CCI 209M	33.0/Blue Dot	Rem. RP12	1205	9,500*
	1½	Win. 209	35.5/Blue Dot	Rem. RP12	1205	8,500*
	1½	Fio. 616	32.5/Blue Dot	Activ T42	1150	9,000*
	1½	Fio. 616	32.5/Blue Dot	Rem. RP12	1150	8,700*
	1½	Fed. 209	32.5/Blue Dot	Activ T42	1150	8,000*
	1½	Rem. 209P	33.5/Blue Dot	Activ T42	1150	8,500*
	1½	Win. 209	33.5/Blue Dot	Activ T42	1150	8,700*
	1½	CCI 209M	34.0/Blue Dot	Activ T42	1150	8,500*
	1⅜	Fio. 616	41.5/Blue Dot	Rem. RP12	1350	9,500*
	1⅜	Fed. 209	39.0/Blue Dot	Rem. RP12	1350	10,200*
	1⅜	CCI 209M	40.0/Blue Dot	Rem. RP12	1350	10,000*
	1⅜	Win. 209	40.0/Blue Dot	Rem. RP12	1350	10,000*
	1⅜	Fio. 616	38.0/Blue Dot	Rem. RP12	1295	9,000*
	1⅜	Fed. 209	36.0/Blue Dot	Rem. RP12	1295	10,000*
	1⅜	CCI 209M	37.0/Blue Dot	Rem. RP12	1295	9,500*
	1⅜	Win. 209	38.0/Blue Dot	Rem. RP12	1295	9,500*
	1¼	Fio. 616	30.0/Herco	Fed. 12S4	1330	9,500*
Case	Shot Wgt. in Oz.	Primer	—Powder— Grains/Type	Wad	Velocity fps	Pressure LUP/psi*

Case	Shot Wgt. in Oz.	Primer	—Powder— Grains/Type	Wad	Velocity fps	Pressure LUP/psi*
Fiocchi Plastic (continued)	$1\frac{1}{4}$	Fio. 616	40.0/Blue Dot	Fed. 12S4	1330	8,500*
	$1\frac{1}{4}$	Fio. 616	30.5/Herco	Rem. SP12	1330	8,500*
	$1\frac{1}{4}$	Fio. 616	30.0/Herco	Win. WAA12F114	1330	9,200*
	$1\frac{1}{4}$	Fed. 209	30.0/Herco	Fed. 12S4	1330	10,500*
	$1\frac{1}{4}$	Fed. 209	37.0/Blue Dot	Fed. 12S4	1330	9,000*
	$1\frac{1}{4}$	CCI 209M	30.0/Herco	Rem. SP12	1330	9,200*
	$1\frac{1}{4}$	Win. 209	30.0/Herco	Win. WAA12F114	1330	10,000*
	$1\frac{1}{4}$	Win. 209	38.5/Blue Dot	Win. WAA12F114	1330	8,500*
Case	Shot Wgt. in Oz.	Primer	—Powder— Grains/Type	Wad	Velocity fps	Pressure LUP/psi*

20-Gauge — 3″ Shells

Case	Shot Wgt. in Oz.	Primer	—Powder— Grains/Type	Wad	Velocity fps	Pressure LUP/psi*
Federal Plastic Hi Power Paper Base Wad	1¼	Fed. 209	19.5/"Hi-Skor" 800-X	Rem. RXP20	1130	10,500
	1⅛	Fed. 209	36.0/Hercules 2400	Rem. SP20	1350	11,000*
	1⅛	Fed. 209	36.0/Hercules 2400	Win. WAA20F1	1350	11,000*
	1⅛	Fed. 209	24.5/Blue Dot	Fed. 12S1	1230	11,200*
	1⅛	Fed. 209	25.5/Blue Dot	Win. WAA20F1	1230	10,500*
	1⅛	Fed. 209	25.5/Blue Dot	Rem. RXP20	1230	11,200*
	1⅛	Win. 209	26.0/SR 4756	Rem. SP20	1285	10,500
	1⅛	Win. 209	26.0/SR 4756	Win. WAA20F1	1255	10,500
	1⅛	Fed. 209	24.0/SR 4756	Win. WAA20F1	1200	10,500
	1⅛	Fed. 209	24.0/SR 4756	Rem. SP20	1200	11,000
	1⅛	Fed. 209	20.5/"Hi-Skor" 800-X	Fed. 20S1	1200	10,500
	1⅛	Fed. 209	21.0/"Hi-Skor" 800-X	Rem. RXP20	1200	10,700
	1¹⁄₁₆	Fed. 209	26.5/Blue Dot	Fed. 20S1	1310	11,000*
	1¹⁄₁₆	Fed. 209	27.5/Blue Dot	Rem. RXP20	1310	11,500*
	1¹⁄₁₆	Fed. 209	27.0/Blue Dot	Win. WAA20	1310	11,000*
	1¹⁄₁₆	Fed. 209	25.0/Blue Dot	Fed. 12S1	1255	10,500*
	1¹⁄₁₆	Fed. 209	25.5/Blue Dot	Win. WAA20	1255	10,200*
Case	Shot Wgt. in Oz.	Primer	—Powder— Grains/Type	Wad	Velocity fps	Pressure LUP/psi*

Case	Shot Wgt. in Oz.	Primer	—Powder— Grains/Type	Wad	Velocity fps	Pressure LUP/psi*
Winchester Plastic Compression Formed	$1\frac{1}{4}$	Win. 209	25.0/Blue Dot	Rem. SP20	1185	11,500*
	$1\frac{1}{4}$	Win. 209	24.0/Blue Dot	Rem. SP20	1135	11,000*
	$1\frac{1}{4}$	Win. 209	23.0/Blue Dot	Win. WAA20F1	1135	10,000*
	$1\frac{1}{4}$	Win. 209	24.0/571	Win. WAA20	1135	11,000
	$1\frac{1}{4}$	CCI 109	24.0/571	Win. WAA20	1135	11,000
	$1\frac{1}{8}$	Win. 209	25.5/Blue Dot	Win. WAA20F1	1230	11,000*
	$1\frac{1}{8}$	Win. 209	25.5/Blue Dot	Rem. SP20	1230	11,000*
	$1\frac{1}{8}$	Win. 209	23.5/SR 4756	Win. WAA20F1	1185	11,000
	$1\frac{1}{8}$	Win. 209	23.5/SR 4756	Rem. SP20	1200	11,000
	$1\frac{1}{8}$	Win. 209	27.0/571	Win. WAA20	1230	11,000
	$1\frac{1}{8}$	CCI 109	27.0/571	Win. WAA20	1230	11,000
	$1\frac{1}{16}$	Win. 209	26.0/Blue Dot	Rem. SP20	1255	10,500*
Case	Shot Wgt. in Oz.	Primer	—Powder— Grains/Type	Wad	Velocity fps	Pressure LUP/psi*

Field Load Index

Field

12-Gauge $2^{3}/_{4}''$ Shells

16-Gauge $2^{3}/_{4}''$ Shells

20-Gauge $2^{3}/_{4}''$ Shells

12-Gauge — 2¾″ Shells

Case	Shot Wgt. in Oz.	Primer	—Powder— Grains/Type	WAD	Velocity fps	Pressure LUP/psi*
Federal Paper Target	1¼	Fed. 209	21.0/Green Dot	Fed. 12C1	1220	10,500*
	1¼	Fed. 209	22.5/Unique	Fed. 12C1	1220	9,500*
	1¼	Fed. 209	23.0/Green Dot	Fed. 12S4	1220	10,500*
	1¼	Fed. 209	24.0/Unique	Fed. 12S4	1220	10,000*
	1¼	Fed. 209	21.0/Green Dot	Rem. SP12	1220	9,500*
	1¼	Fed. 209	22.0/Unique	Rem. SP12	1220	9,500*
	1¼	Fed. 209	21.0/Green Dot	Win. WAA12	1220	10,500*
	1¼	Fed. 209	22.0/Unique	Win. WAA12	1220	10,000*
	1¼	Fed. 209	23.0/Green Dot	Win. WAA12F114	1220	10,000*
	1¼	Fed. 209	23.5/Unique	Win. WAA12F114	1220	9,500*
	1¼	Rem. 209P	23.0/Green Dot	Fed. 12S4	1220	10,000*
	1¼	Rem. 209P	25.5/Unique	Fed. 12S4	1220	9,000*
	1¼	Win. 209	24.5/Unique	Fed. 12S4	1220	10,500*
	1¼	CCI 209M	23.0/Green Dot	Fed. 12S4	1220	10,500*
	1¼	CCI 209M	25.5/Unique	Fed. 12S4	1220	9,700*
	1¼	Win. 209	21.0/"Hi-Skor" 700-X	Rem. SP12	1220	10,000
	1¼	Fed. 209	25.0/"Hi-Skor" 800-X	Fed. 12S4	1220	8,500
Case	Shot Wgt. in Oz.	Primer	—Powder— Grains/Type	WAD	Velocity fps	Pressure LUP/psi*

12-Gauge – $2\frac{3}{4}''$ Shells

Case	Shot Wgt. in Oz.	Primer	—Powder— Grains/Type	WAD	Velocity fps	Pressure LUP/psi*
Federal Paper Target (continued)	1¼	Fed. 209	25.5/"Hi-Skor" 800-X	Win. WAA12F114	1220	8,200
	1¼	Rem. 209P	20.0/"Hi-Skor" 700-X	Rem. SP12	1190	10,500
	1⅛	Fed. 209	21.0/Red Dot	Fed. 12C1	1255	10,200*
	1⅛	Fed. 209	22.5/Unique	Fed. 12C1	1255	9,000*
	1⅛	Fed. 209	21.0/Red Dot	Fed. 12S3	1255	9,500*
	1⅛	Fed. 209	23.0/Green Dot	Fed. 12S3	1255	9,000*
	1⅛	Fed. 209	21.5/Green Dot	Rem. R12H	1255	10,000*
	1⅛	Fed. 209	22.5/Unique	Rem. R12H	1255	9,000*
	1⅛	Fed. 209	21.0/Red Dot	Rem. RXP12	1255	10,000*
	1⅛	Fed. 209	21.5/Green Dot	Rem. RXP12	1255	9,500*
	1⅛	Fed. 209	22.0/Unique	Rem. RXP12	1255	8,500*
	1⅛	Fed. 209	21.5/Green Dot	Win. WAA12	1255	10,500*
	1⅛	Fed. 209	22.0/Unique	Win. WAA12	1255	9,500*
	1⅛	Rem. 209P	21.5/Red Dot	Fed. 12C1	1255	10,700*
	1⅛	Win. 209	21.0/Red Dot	Fed. 12C1	1255	10,500*
	1⅛	Win. 209	22.5/Green Dot	Fed. 12C1	1255	9,000*
	1⅛	Win. 209	24.5/Unique	Fed. 12C1	1255	8,500*
	1⅛	CCI 209M	21.0/Red Dot	Fed. 12C1	1255	10,500*
Case	Shot Wgt. in Oz.	Primer	—Powder— Grains/Type	WAD	Velocity fps	Pressure LUP/psi*

Case	Shot Wgt. in Oz.	Primer	—Powder— Grains/Type	WAD	Velocity fps	Pressure LUP/psi*
Federal Paper Target (continued)	1⅛	CCI 209M	22.5/Green Dot	Fed. 12C1	1255	8,500*
	1⅛	CCI 209M	24.5/Unique	Fed. 12C1	1255	8,500*
Federal Plastic Gold Medal	1¼	CCI 209	27.0/WSF	Fed. 12S4	1275	9,200*
	1¼	Fed. 209	24.0/Unique	Fed. 12S4	1220	10,500*
	1¼	Fed. 209	25.0/Herco	Fed. 12S4	1220	10,200*
	1¼	Fed. 209	24.0/Unique	Rem. SP12	1220	10,500*
	1¼	Fed. 209	26.0/Herco	Rem. SP12	1220	9,700*
	1¼	Fed. 209	24.0/Unique	Win. WAA12F114	1220	10,500*
	1¼	Fed. 209	25.0/Herco	Win. WAA12F114	1220	10,000*
	1¼	Rem. 209P	25.0/Unique	Fed. 12S4	1220	10,000*
	1¼	Rem. 209P	25.5/Herco	Fed. 12S4	1220	8,000*
	1¼	Win. 209	24.0/Unique	Fed. 12S4	1220	9,500*
	1¼	Win. 209	25.5/Herco	Fed. 12S4	1220	9,500*
	1¼	CCI 209M	24.5/Unique	Fed. 12S4	1220	9,500*
	1¼	CCI 209M	25.5/Herco	Fed. 12S4	1220	8,700*
	1¼	Fed. 209	20.5/"Hi-Skor" 700-X	Fed. 12S4	1220	11,000
	1¼	Fed. 209	21.0/"Hi-Skor" 700-X	Rem. R12H	1220	10,500*
	1¼	Fed. 209	25.0/"Hi-Skor" 800-X	Fed. 12S3	1220	8,500
Case	Shot Wgt. in Oz.	Primer	—Powder— Grains/Type	WAD	Velocity fps	Pressure LUP/psi*

Field

12-Gauge — 2¾″ Shells

Case	Shot Wgt. in Oz.	Primer	—Powder— Grains/Type	WAD	Velocity fps	Pressure LUP/psi*
Federal Plastic Gold Medal (continued)	1¼	Win. 209	20.5/"Hi-Skor" 700-X	Fed. 12S4	1220	10,500
	1¼	Win. 209	21.0/"Hi-Skor" 700-X	Rem. R12H	1220	10,000
	1⅛	Fed. 209	22.5/Green Dot	Fed. 12S3	1255	10,000*
	1⅛	Fed. 209	24.0/Unique	Fed. 12S3	1255	10,500*
	1⅛	Fed. 209	21.0/Red Dot	Rem. RXP12	1255	10,700*
	1⅛	Fed. 209	22.5/Green Dot	Rem. RXP12	1255	10,000*
	1⅛	Fed. 209	24.5/Unique	Rem. RXP12	1255	10,000*
	1⅛	Fed. 209	22.5/Green Dot	Win. WAA12	1255	10,200*
	1⅛	Fed. 209	24.0/Unique	Win. WAA12	1255	9,500*
	1⅛	Rem. 209P	23.0/Green Dot	Fed. 12S3	1255	9,000*
	1⅛	Win. 209	22.5/Green Dot	Fed. 12S3	1255	10,500*
	1⅛	Win. 209	24.0/Unique	Fed. 12S3	1255	10,000*
	1⅛	CCI 209M	22.5 Green Dot	Fed. 12S3	1255	10,000*
	1⅛	CCI 209M	24.0/Unique	Fed. 12S3	1255	9,000*
	1⅛	Fed. 209	21.0/"Hi-Skor" 700-X	Fed. 12S3	1255	9,700
	1⅛	Fed. 209	21.0/"Hi-Skor" 700-X	Rem. R12L	1255	9,200
	1⅛	Win. 209	20.5 /"Hi-Skor" 700-X	Fed. 12S3	1255	9,200
Case	Shot Wgt. in Oz.	Primer	—Powder— Grains/Type	WAD	Velocity fps	Pressure LUP/psi*

Case	Shot Wgt. in Oz.	Primer	—Powder— Grains/Type	WAD	Velocity fps	Pressure LUP/psi*
Federal Plastic Hi Power Paper Base Wad	1¼	Fed. 209	23.0/Unique	Fed. 12C1	1220	9,000
	1¼	Fed. 209	23.0/Green Dot	Fed. 12S4	1220	10,000*
	1¼	Fed. 209	23.0/Unique	Fed. 12S4	1220	9,500*
	1¼	Fed. 209	22.0/Green Dot	Rem. R12H	1220	10,500*
	1¼	Fed. 209	22.0/Green Dot	Rem. RXP12	1220	9,500*
	1¼	Fed. 209	23.0/Unique	Rem. RXP12	1220	8,500*
	1¼	Fed. 209	21.5/Green Dot	Win. WAA12	1220	9,500*
	1¼	Fed. 209	23.0/Unique	Win. WAA12	1220	9,500*
	1¼	Fed. 209	23.0/Green Dot	Win. WAA12F114	1220	10,000*
	1¼	Fed. 209	23.0/Unique	Win. WAA12F114	1220	9,500*
	1¼	Fed. 209	21.0/"Hi-Skor" 700-X	Rem. SP12	1220	10,500*
	1¼	Fed. 209	25.5/PB	Rem. RP12	1220	8,700*
	1⅛	Fed. 209	21.0/Red Dot	Fed. 12C1	1255	10,200*
	1⅛	Fed. 209	22.0/Green Dot	Fed. 12C1	1255	10,000*
	1⅛	Fed. 209	21.5/Red Dot	Fed. 12S3	1255	10,000*
	1⅛	Fed. 209	22.0/Green Dot	Fed. 12S3	1255	9,000*
	1⅛	Fed. 209	24.0/Unique	Fed. 12S3	1255	8,000*
	1⅛	Fed. 209	21.0/Red Dot	Rem. RXP12	1255	10,000*

| Case | Shot Wgt. in Oz. | Primer | —Powder— Grains/Type | WAD | Velocity fps | Pressure LUP/psi* |

12-Gauge – $2^3/_4$″ Shells

Case	Shot Wgt. in Oz.	Primer	—Powder— Grains/Type	WAD	Velocity fps	Pressure LUP/psi*
Federal Plastic Hi Power Paper Base Wad (continued)	$1^1/_8$	Fed. 209	22.5/Green Dot	Rem. RXP12	1255	10,000*
	$1^1/_8$	Fed. 209	22.0/Green Dot	Win. WAA12	1255	10,500*
	$1^1/_8$	Rem. 209P	22.0/Red Dot	Fed. 12S3	1255	10,500*
	$1^1/_8$	Rem. 209P	23.0/Green Dot	Fed. 12S3	1255	8,500*
	$1^1/_8$	Win. 209	21.5/Red Dot	Fed. 12S3	1255	10,700*
	$1^1/_8$	Win. 209	23.0/Green Dot	Fed. 12S3	1255	9,500*
	$1^1/_8$	Win. 209	25.0/Unique	Fed. 12S3	1255	9,000*
	$1^1/_8$	CCI 209M	21.5/Red Dot	Fed. 12S3	1255	10,000*
	$1^1/_8$	CCI 209M	22.0/Green Dot	Fed. 12S3	1255	9,500*
	$1^1/_8$	CCI 209M	25.5/Unique	Fed. 12S3	1255	8,500*
	$1^1/_8$	Fed. 209	21.0/"Hi-Skor" 700-X	Fed. 12S4	1255	10,500
	$1^1/_8$	Fed. 209	24.5/PB	Fed. 12S4	1255	8,000
Federal Plastic Unibody	$1^1/_4$	Fed. 209	28.0/Herco	Fed. 12S4	1275	9,500*
	$1^1/_4$	Fed. 209	27.5/Herco	Rem. SP12	1275	8,200*
	$1^1/_4$	Fed. 209	27.5/Herco	Win. WAA12F114	1275	8,700*
	$1^1/_4$	Win. 209	27.5/Herco	Fed. 12S4	1275	9,000*
	$1^1/_4$	CCI 209M	27.5/Herco	Fed. 12S4	1275	9,500*
	$1^1/_4$	Fed. 209	25.0/Unique	Fed. 12S4	1220	9,000*
Case	Shot Wgt. in Oz.	Primer	—Powder— Grains/Type	WAD	Velocity fps	Pressure LUP/psi*

Case	Shot Wgt. in Oz.	Primer	—Powder— Grains/Type	WAD	Velocity fps	Pressure LUP/psi*
Federal Plastic Unibody (continued)	1¼	Fed. 209	26.0/Herco	Fed. 12S4	1220	8,500*
	1¼	Fed. 209	25.5/Unique	Rem. SP12	1220	8,700*
	1¼	Fed. 209	25.0/Unique	Win. WAA12F114	1220	8,700*
	1¼	Win. 209	25.0/Unique	Fed. 12S4	1220	9,200*
	1¼	Win. 209	26.0/Herco	Fed. 12S4	1220	8,500*
	1¼	CCI 209M	25.5/Unique	Fed. 12S4	1220	9,200*
	1¼	CCI 209M	26.0/Herco	Fed. 12S4	1220	9,000*
Remington Plastic Premier Target	1¼	Rem. 209P	34.5/Blue Dot	Rem. SP12	1275	8,500*
	1¼	Rem. 209P	34.0/Blue Dot	Fed. 12S4	1275	10,000*
	1¼	Rem. 209P	26.5/Herco	Win. WAA12F114	1275	10,500*
	1¼	Rem. 209P	27.0/Herco	Activ T35	1275	10,000*
	1¼	Rem. 209P	35.0/Blue Dot	Activ T35	1275	8,500*
	1¼	Fed. 209	35.0/Blue Dot	Rem. SP12	1275	9,000*
	1¼	Win. 209	26.0/Herco	Rem. SP12	1275	10,500*
	1¼	Win. 209	35.5/Blue Dot	Rem. SP12	1275	9,000*
	1¼	CCI 209M	34.5/Blue Dot	Rem. SP12	1275	10,000*
	1¼	Fio. 616	35.5/Blue Dot	Rem. SP12	1275	9,500*
	1¼	Rem. 209P	23.5/Unique	Rem. SP12	1220	9,500*
	1¼	Rem. 209P	25.0/Herco	Rem. SP12	1220	9,500*

| Case | Shot Wgt. in Oz. | Primer | —Powder— Grains/Type | WAD | Velocity fps | Pressure LUP/psi* |

12-Gauge — $2^3/_4$″ Shells

Case	Shot Wgt. in Oz.	Primer	—Powder— Grains/Type	WAD	Velocity fps	Pressure LUP/psi*
Remington Plastic Premier Target (continued)	1¼	Rem. 209P	23.0/Unique	Fed. 12S4	1220	10,700*
	1¼	Rem. 209P	25.0/Herco	Fed. 12S4	1220	10,500*
	1¼	Rem. 209P	24.0/Unique	Win. WAA12F114	1220	10,000*
	1¼	Rem. 209P	24.5/Herco	Win. WAA12F114	1220	9,500*
	1¼	Rem. 209P	23.5/Unique	Activ T32	1220	9,500*
	1¼	Rem. 209P	25.0/Herco	Activ T32	1220	9,000*
	1¼	Fed. 209	23.0/Unique	Rem. SP12	1220	10,000*
	1¼	Fed. 209	25.0/Herco	Rem. SP12	1220	10,000*
	1¼	Win. 209	23.5/Unique	Rem. SP12	1220	10,000*
	1¼	Win. 209	24.5/Herco	Rem. SP12	1220	9,500*
	1¼	CCI 209M	23.5/Unique	Rem. SP12	1220	10,500*
	1¼	CCI 209M	24.5/Herco	Rem. SP12	1220	10,000*
	1¼	Fio. 616	23.0/Unique	Rem. SP12	1220	9,500*
	1¼	Fio. 616	24.5/Herco	Rem. SP12	1220	9,500*
	1⅛	Rem. 209P	22.5/Green Dot	Rem. RXP12	1255	9,200*
	1⅛	Rem. 209P	24.0/Unique	Rem. RXP12	1255	9,300*
	1⅛	Rem. 209P	22.0/Green Dot	Rem. R12H	1255	10,200*
	1⅛	Rem. 209P	24.0/Unique	Rem. R12H	1255	9,500*
Case	Shot Wgt. in Oz.	Primer	—Powder— Grains/Type	WAD	Velocity fps	Pressure LUP/psi*

Case	Shot Wgt. in Oz.	Primer	—Powder— Grains/Type	WAD	Velocity fps	Pressure LUP/psi*
Remington Plastic Premier Target (continued)	1⅛	Rem. 209P	23.0/Green Dot	Win. WAA12	1255	10,500*
	1⅛	Rem. 209P	24.5/Unique	Win. WAA12	1255	8,200*
	1⅛	Rem. 209P	21.5/Green Dot	Fed. 12S3	1255	10,500*
	1⅛	Rem. 209P	23.5/Unique	Fed. 12S3	1255	9,500*
	1⅛	Fed. 209	22.0/Green Dot	Rem. RXP12	1255	10,500*
	1⅛	Fed. 209	24.0/Unique	Rem. RXP12	1255	10,000*
	1⅛	Win. 209	22.0/Green Dot	Rem. RXP12	1255	9,500*
	1⅛	Win. 209	24.5/Unique	Rem. RXP12	1255	9,000*
	1⅛	CCI 209M	22.0/Green Dot	Rem. RXP12	1255	9,500*
	1⅛	CCI 209M	24.0/Unique	Rem. RXP12	1255	10,200*
	1⅛	Fio. 616	22.0/Green Dot	Rem. RXP12	1255	9,000*
	1⅛	Fio. 616	23.5/Unique	Rem. RXP12	1255	9,000*
Remington Plastic Unibody SP	1¼	Fed. 209	32.5/Blue Dot	Rem. SP12	1275	10,500*
	1¼	CCI 209	35.5/Blue Dot	Rem. SP12	1275	9,000*
	1¼	CCI 209M	33.5/Blue Dot	Rem. SP12	1275	10,000*
	1¼	Win. 209	35.0/Blue Dot	Rem. SP12	1275	10,500*
	1¼	Fed. 209	22.5/Unique	Rem. SP12	1220	10,700*
	1¼	Fed. 209	23.5/Herco	Rem. SP12	1220	10,500*
	1¼	Fed. 209	31.5/Blue Dot	Rem. SP12	1220	10,000*
Case	Shot Wgt. in Oz.	Primer	—Powder— Grains/Type	WAD	Velocity fps	Pressure LUP/psi*

Field

12-Gauge – 2¾″ Shells

Case	Shot Wgt. in Oz.	Primer	—Powder— Grains/Type	WAD	Velocity fps	Pressure LUP/psi*
Remington Plastic Unibody SP (continued)	1¼	CCI 209	24.5/Unique	Rem. SP12	1220	9,600*
	1¼	CCI 209	25.5/Herco	Rem. SP12	1220	9,000*
	1¼	CCI 209M	23.0/Unique	Rem. SP12	1220	10,000*
	1¼	CCI 209M	32.0/Blue Dot	Rem. SP12	1220	8,500*
	1¼	Win. 209	23.0/Unique	Rem. SP12	1220	10,500*
	1¼	Win. 209	24.5/Herco	Rem. SP12	1220	10,500*
	1¼	Win. 209	33.0/Blue Dot	Rem. SP12	1220	9,000*
	1¼	Rem. 209P	25.0/"Hi-Skor" 800-X	Rem. SP12	1220	9,500
	1¼	Fed. 209	23.0/PB	Rem. RP12	1220	11,000
	1¼	Fed. 209	23.0/PB	Win. WAA12R	1220	10,500
	1¼	CCI 209	26.0/SR 7625	Rem. RP12	1220	8,200
	1¼	Fed. 209	25.0/SR 7625	Rem. RP12	1220	9,000
	1¼	CCI 209	26.5/SR 7625	Win. WAA12R	1220	8,000
	1¼	Fed. 209	25.5/SR 7625	Win. WAA12R	1220	9,000
	1¼	Fed. 209	28.5/SR 4756	Rem. RP12	1220	9,000
	1¼	Win. 209	29.5/SR 4756	Rem. RP12	1220	8,700
	1⅛	Rem. 209	21.0/Green Dot	Rem. R12H	1255	10,400*
	1⅛	Rem. 97*	21.0/Green Dot	Rem. RXP12	1255	10,500*
Case	Shot Wgt. in Oz.	Primer	—Powder— Grains/Type	WAD	Velocity fps	Pressure LUP/psi*

Field

Case	Shot Wgt. in Oz.	Primer	—Powder— Grains/Type	WAD	Velocity fps	Pressure LUP/psi*
Remington Plastic Unibody SP (continued)	1⅛	Fed. 209	20.5/Green Dot	Rem. RXP12	1255	10,200*
	1⅛	Fed. 209	23.0/Unique	Rem. RXP12	1255	10,000*
	1⅛	CCI 209	22.5/Green Dot	Rem. RXP12	1255	10,500*
	1⅛	CCI 209	23.0/Unique	Rem. RXP12	1255	9,000*
	1⅛	CCI 209M	21.0/Green Dot	Rem. RXP12	1255	10,000*
	1⅛	CCI 209M	23.0/Unique	Rem. RXP12	1255	9,700*
	1⅛	Win. 209	21.5/Green Dot	Rem. RXP12	1255	10,700*
	1⅛	Win. 209	23.5/Unique	Rem. RXP12	1255	10,000*
	1⅛	CCI 209	24.5/PB	Rem. R12H	1255	8,000
Winchester Plastic AA Compression Formed	1¼	CCI 209	29.0/WSF	Rem. RXP12	1275	10,500*
	1¼	Win. 209	27.5/WSF	Fed. 12S4	1275	11,000
	1¼	Win. 209	28.0/WSF	Win. WAA12F114	1275	9,700*
	1¼	Win. 209	26.5/Herco	Win. WAA12F114	1275	10,700*
	1¼	Win. 209	34.5/Blue Dot	Win. WAA12F114	1275	10,000*
	1¼	Win. 209	35.0/Blue Dot	Rem. SP12	1275	8,200*
	1¼	Win. 209	26.0/Herco	Fed. 12S4	1275	10,700*
	1¼	Win. 209	34.0/Blue Dot	Fed. 12S4	1275	10,500*
	1¼	Win. 209	26.0/Herco	Activ T35	1275	10,700*
	1¼	Win. 209	34.5/Blue Dot	Activ T35	1275	9,000*
Case	Shot Wgt. in Oz.	Primer	—Powder— Grains/Type	WAD	Velocity fps	Pressure LUP/psi*

Field

12-Gauge — $2\frac{3}{4}$″ Shells

Case	Shot Wgt. in Oz.	Primer	—Powder— Grains/Type	WAD	Velocity fps	Pressure LUP/psi*
Winchester Plastic AA Compression Formed (continued)	1¼	Win. 209	33.0/540	Win. WAA12	1255	9,000
	1¼	Win. 209	31.0/540	Win. WAA12F114	1255	9,000
	1¼	Win. 209	33.0/540	Rem. R12H	1255	9,000
	1¼	Win. 209	33.0/540	Fed. 12C1	1255	9,000
	1¼	Win. 209	23.5/Unique	Fed. 12S4	1220	10,500*
	1¼	Win. 209	25.0/Herco	Fed. 12S4	1220	9,500*
	1¼	Win. 209	22.5/Unique	Rem. RP12	1220	9,500*
	1¼	Win. 209	23.5/Unique	Win. WAA12F114	1220	10,000*
	1¼	Win. 209	25.0/Herco	Win. WAA12F114	1220	8,500*
	1¼	Fed. 209	23.0/Unique	Win. WAA12F114	1220	10,000*
	1¼	Fed. 209	24.0/Herco	Win. WAA12F114	1220	10,000*
	1¼	Rem. 209P	24.0/Unique	Win. WAA12F114	1220	10,000*
	1¼	Rem. 209P	25.5/Herco	Win. WAA12F114	1220	8,500*
	1¼	CCI 209M	23.5/Unique	Win. WAA12F114	1220	10,000*
	1¼	CCI 209M	24.0/Herco	Win. WAA12F114	1220	9,000*
	1¼	Fio. 616	23.0/Unique	Win. WAA12F114	1220	10,300*
	1¼	Fio. 616	25.0/Herco	Win. WAA12F114	1220	10,000*
	1¼	Win. 209	25.0/"Hi-Skor" 800-X	Win. WAA12F114	1220	8,500
Case	Shot Wgt. in Oz.	Primer	—Powder— Grains/Type	WAD	Velocity fps	Pressure LUP/psi*

Case	Shot Wgt. in Oz.	Primer	—Powder— Grains/Type	WAD	Velocity fps	Pressure LUP/psi*
Winchester Plastic AA Compression Formed (continued)	1¼	Win. 209	25.0/"Hi-Skor" 800-X	Rem. SP12	1220	8,500
	1¼	Win. 209	24.5/"Hi-Skor" 800-X	Fed. 12S4	1220	9,000
	1¼	Fed. 209	24.5/"Hi-Skor" 800-X	Win. WAA12F114	1220	9,000
	1¼	Fed. 209	24.5/"Hi-Skor" 800-X	Rem. SP12	1220	9,000
	1¼	Fed. 209	24.5/"Hi-Skor" 800-X	Fed. 12S4	1220	10,000
	1¼	Win. 209	26.0/WSF	Fed. 12S4	1220	9,000*
	1¼	Win. 209	31.5/540	Win. WAA12	1220	9,000
	1¼	Win. 209	30.0/540	Win. WAA12F114	1220	8,500
	1¼	Win. 209	31.5/540	Rem. R12H	1220	9,000
	1⅛	Win. 209	21.0/Green Dot	Fed. 12C1	1255	10,200*
	1⅛	Win. 209	23.0/Unique	Fed. 12C1	1255	8,500*
	1⅛	Win. 209	23.0/Green Dot	Fed. 12C2	1255	9,200*
	1⅛	Win. 209	22.0/Green Dot	Fed. 12S3	1255	10,000*
	1⅛	Win. 209	24.0/Unique	Fed. 12S3	1255	9,500*
	1⅛	Win. 209	21.0/Green Dot	Rem. R12H	1255	10,000*
	1⅛	Win. 209	22.0/Herco	Rem. R12H	1255	8,500*
	1⅛	Win. 209	21.0/Green Dot	Rem. RXP12	1255	9,500*
	1⅛	Win. 209	22.5/Unique	Rem. RXP12	1255	8,700*

Case	Shot Wgt. in Oz.	Primer	—Powder— Grains/Type	WAD	Velocity fps	Pressure LUP/psi*

12-Gauge – $2\frac{3}{4}''$ Shells

Case	Shot Wgt. in Oz.	Primer	—Powder— Grains/Type	WAD	Velocity fps	Pressure LUP/psi*
Winchester Plastic AA Compression Formed (continued)	1⅛	Win. 209	21.5/Green Dot	Win. WAA12	1255	10,500*
	1⅛	Win. 209	23.5/Unique	Win. WAA12	1255	9,000*
	1⅛	Fed. 209	24.0/Unique	Win. WAA12	1255	10,000*
	1⅛	Rem. 209P	24.0/Unique	Win. WAA12	1255	9,500*
	1⅛	Fio. 616	22.0/Red Dot	Win. WAA12	1255	10,500*
	1⅛	Fio. 616	23.5/Green Dot	Win. WAA12	1255	10,000*
	1⅛	Win. 209	21.5/WSL	Win. WAA12SL	1255	11,000*
	1⅛	Win. 209	21.0/WSL	Win. WAA12	1255	11,000*
	1⅛	Win. 209	21.0/WSL	Rem. RXP12	1255	11,000*
	1⅛	Win. 209	21.0/WSL	Rem. Fig. 8	1255	11,000*
	1⅛	Win. 209	21.5/WSL	Rem. R12L	1255	11,000*
	1⅛	CCI 209	21.0/WSL	Win. WAA12SL	1255	11,000*
	1⅛	CCI 209	21.0/WSL	Rem. RXP12	1255	10,700*
	1⅛	CCI 209	21.0/WSL	Rem. Fig. 8	1255	11,000*
	1⅛	CCI 209	21.0/WSL	Rem. R12L	1255	10,500*
	1⅛	Fed. 209	21.5/WSL	Win. WAA12SL	1255	10,500
	1⅛	Fed. 209	21.0/WSL	Rem. RXP12	1255	10,700*
	1⅛	Fed. 209	21.5/WSL	Rem. Fig. 8	1255	11,000*
Case	Shot Wgt. in Oz.	Primer	—Powder— Grains/Type	WAD	Velocity fps	Pressure LUP/psi*

Field

Case	Shot Wgt. in Oz.	Primer	—Powder— Grains/Type	WAD	Velocity fps	Pressure LUP/psi*
Winchester Plastic AA Compression Formed (continued)	1⅛	Fed. 209	21.5/WSL	Rem. R12L	1255	10,500*
Activ Plastic	1¼	CCI 209	23.0/Green Dot	Activ T32	1220	9,500*
	1¼	CCI 209	25.5/Unique	Activ T32	1220	8,000*
	1¼	CCI 209	23.5/Green Dot	Win. WAA12	1220	9,000*
	1¼	CCI 209	25.5/Unique	Win. WAA12	1220	8,500*
	1¼	CCI 209M	22.0/Green Dot	Activ T32	1220	9,500*
	1¼	CCI 209M	24.5/Unique	Activ T32	1220	9,000*
	1¼	CCI 209M	22.5/Green Dot	Win. WAA12	1220	10,000*
	1¼	CCI 209M	24.5/Unique	Win. WAA12	1220	9,000*
	1¼	Fed. 209	22.5/Green Dot	Activ T32	1220	10,000*
	1¼	Fed. 209	24.5/Unique	Activ T32	1220	9,200*
	1¼	Fed. 209	22.5/Green Dot	Win. WAA12	1220	10,000*
	1¼	Fed. 209	24.5/Unique	Win. WAA12	1220	9,500*
	1¼	Win. 209	23.0/Green Dot	Activ T32	1220	9,700*
	1¼	Win. 209	22.0/Green Dot	Rem. RXP12	1220	10,000*
	1¼	Win. 209	22.0/Green Dot	Win. WAA12	1220	10,200*
	1¼	Win. 209	24.0/Unique	Win. WAA12	1220	9,200*
	1⅛	CCI 209M	22.0/Green Dot	Fed. 12S3	1255	9,500*
	1⅛	CCI 209M	23.0/Green Dot	Win. WAA12	1255	9,000*
Case	Shot Wgt. in Oz.	Primer	—Powder— Grains/Type	WAD	Velocity fps	Pressure LUP/psi*

12-Gauge – $2\frac{3}{4}$″ Shells

Case	Shot Wgt. in Oz.	Primer	—Powder— Grains/Type	WAD	Velocity fps	Pressure LUP/psi*
Fiocchi Plastic	$1\frac{1}{4}$	Fio. 616	23.0/Green Dot	Fed. 12S4	1220	9,700*
	$1\frac{1}{4}$	Fio. 616	25.0/Unique	Fed. 12S4	1220	9,000*
	$1\frac{1}{4}$	Fed. 209	23.0/Green Dot	Fed. 12S4	1220	10,000*
	$1\frac{1}{4}$	Fed. 209	24.5/Unique	Fed. 12S4	1220	9,500*
	$1\frac{1}{4}$	CCI 209M	24.5/Green Dot	Rem. R12H	1220	8,000*
	$1\frac{1}{4}$	Win. 209	23.0/Green Dot	Win. WAA12F114	1220	10,000*
	$1\frac{1}{4}$	Win. 209	25.0/Unique	Win. WAA12F114	1220	8,700*
	$1\frac{1}{8}$	Fio. 616	24.0/Green Dot	Fed. 12S3	1255	9,200*
	$1\frac{1}{8}$	Fed. 209	23.5/Green Dot	Fed. 12S3	1255	9,000*
	$1\frac{1}{8}$	CCI 209M	23.5/Green Dot	Rem. RXP12	1220	9,000*
	$1\frac{1}{8}$	Win. 209	23.5/Green Dot	Win. WAA12	1220	8,500*
Case	Shot Wgt. in Oz.	Primer	—Powder— Grains/Type	Wad	Velocity fps	Pressure LUP/psi*

16-Gauge — 2¾″ Shells

Case	Shot Wgt. in Oz.	Primer	—Powder— Grains/Type	Wad	Velocity fps	Pressure LUP/psi*
Federal Plastic Hi-Power Paper Base Wad	1¼	Fed. 209	30.5/Blue Dot	Rem. SP16	1260	10,200*
	1⅛	Fed. 209	24.5/Herco	Rem. SP16	1295	10,500*
	1⅛	Fed. 209	32.0/Blue Dot	Rem. SP16	1295	8,500*
	1⅛	CCI 209M	23.5/"Hi-Skor" 800-X	Rem. SP16	1295	10,000*
	1⅛	CCI 209	24.5/SR 7625	Rem. SP16	1295	10,200*
	1⅛	Fed. 209	22.0/Unique	Win. WAA16	1240	10,200*
	1⅛	Fed. 209	24.0/Herco	Win. WAA16	1240	10,200*
	1⅛	Fed. 209	22.5/Unique	Rem. SP16	1240	9,500*
	1⅛	Fed. 209	23.5/Herco	Rem. SP16	1240	10,000*
	1⅛	Fed. 209	21.5/"Hi-Skor" 800-X	Rem. SP16	1240	9,500
	1⅛	CCI 209M	22.0/"Hi-Skor" 800-X	Rem. SP16	1240	9,000
Winchester Plastic Compression Formed	1¼	Win. 209	30.5/571	Rem. SP16	1240	10,500*
	1⅛	Win. 209	28.5/540	Rem. SP16	1295	10,500*
	1⅛	CCI 109	28.5/540	Rem. SP16	1295	9,500*
	1⅛	Rem. 209P	24.0/"Hi-Skor" 800-X	Rem. SP16	1295	8,500
	1⅛	Win. 209	21.5/"Hi-Skor" 800-X	Rem. SP16	1240	10,000
Case	Shot Wgt. in Oz.	Primer	—Powder— Grains/Type	Wad	Velocity fps	Pressure LUP/psi*

16-Gauge – 2¾″ Shells

Case	Shot Wgt. in Oz.	Primer	—Powder— Grains/Type	Wad	Velocity fps	Pressure LUP/psi*
Winchester Compression Formed (continued)	1⅛	CCI 209M	21.5/"Hi-Skor" 800-X	Rem. SP16	1240	9,500
	1⅛	CCI 109	27.5/540	Rem. SP16	1240	9,200*
	1⅛	Win. 209	27.5/540	Rem. SP16	1240	9,500*
	1⅛	Win. 209	27.0/571	Win. WAA16	1240	11,000*
	1⅛	Fed. 209	26.5/571	Win. WAA16	1240	11,000*
	1⅛	CCI 209	27.5/571	Win. WAA16	1240	11,000*
Case	Shot Wgt. in Oz.	Primer	—Powder— Grains/Type	Wad	Velocity fps	Pressure LUP/psi*

20-Gauge — 2¾″ Shells

Case	Shot Wgt. in Oz.	Primer	—Powder— Grains/Type	Wad	Velocity fps	Pressure LUP/psi*
Federal Plastic Target	1⅛	Fed. 209	19.0/"Hi-Skor" 800-X	Rem. SP20	1175	10,700
	1⅛	Win. 209	19.0/"Hi-Skor" 800-X	Win. WAA20F1	1175	10,700
	1⅛	Win. 209	22.0/SR 4756	Rem. RP20	1175	10,700
Remington Plastic Premier Target	1⅛	Rem. 209P	22.0/Blue Dot	Rem. SP20	1175	11,500*
	1⅛	Rem. 209P	22.0/Blue Dot	Win. WAA20F1	1175	11,500*
Winchester Plastic AA Compression Formed	1⅛	Win. 209	24.5/571	Rem. RP20	1175	10,200*
	1⅛	Fed. 209	24.0/571	Rem. RP20	1175	11,000
	1⅛	CCI 109	24.5/571	Rem. RP20	1175	10,500
	1⅛	Win. 209	24.0/571	Win. WAA20F1	1145	10,800
Fiocchi Plastic	1⅛	Fio. 616	23.5/Blue Dot	Rem. SP20	1175	10,000*
	1⅛	Fed. 209	23.5/Blue Dot	Rem. SP20	1175	10,700*
	1⅛	Win. 209	23.5/Blue Dot	Rem. SP20	1175	11,500*
Case	Shot Wgt. in Oz.	Primer	—Powder— Grains/Type	Wad	Velocity fps	Pressure LUP/psi*

Field

Light Field Load Index

12-Gauge — $2\frac{3}{4}''$ Shells

Case	Shot Wgt. in Oz.	Primer	—Powder— Grains/Type	Wad	Velocity fps	Pressure LUP/psi*
Federal Paper Target	1⅛	Fed. 209	19.0/Red Dot	Fed. 12C1	1200	9,500*
	1⅛	Fed. 209	19.0/Red Dot	Fed. 12S3	1200	10,000*
	1⅛	Fed. 209	19.5/Red Dot	Rem. R12L	1200	9,500*
	1⅛	Fed. 209	19.0/Red Dot	Rem. R12H	1200	9,200*
	1⅛	Fed. 209	19.0/Red Dot	Rem. RXP12	1200	10,000*
	1⅛	Fed. 209	19.0/Red Dot	Win. WAA12	1200	10,500*
	1⅛	Rem. 209P	20.0/Red Dot	Fed. 12C1	1200	9,200*
	1⅛	Win. 209	19.5/Red Dot	Fed. 12C1	1200	10,000*
	1⅛	CCI 109	19.0/Red Dot	Fed. 12C1	1200	9,200*
	1⅛	CCI 209M	20.0/Red Dot	Fed. 12C1	1200	8,700*
	1⅛	Fed. 209	19.5/"Hi-Skor" 700-X	Fed. 12C1	1200	9,000
	1⅛	Fed. 209	20.5/"Hi-Skor" 700-X	Rem. R12L	1200	8,500
	1⅛	Fed. 209	19.0/"Hi-Skor" 700-X	Win. WAA12	1200	9,200
	1⅛	CCI 209	20.0/"Hi-Skor" 700-X	Fed. 12C1	1200	9,500
	1⅛	CCI 209	19.5/"Hi-Skor" 700-X	Win. WAA12	1200	8,500

| Case | Shot Wgt. in Oz. | Primer | —Powder— Grains/Type | Wad | Velocity fps | Pressure LUP/psi* |

12-Gauge – $2^3/_4''$ Shells

Case	Shot Wgt. in Oz.	Primer	—Powder— Grains/Type	Wad	Velocity fps	Pressure LUP/psi*
Federal Paper Target (continued)	1⅛	Rem. 209P	18.5/"Hi-Skor" 700-X	Fed. 12C1	1200	8,500
	1⅛	Rem. 209P	19.0/"Hi-Skor" 700-X	Activ L33	1200	9,000
	1⅛	Rem. 209P	18.5/"Hi-Skor" 700-X	Rem. R12L	1200	8,000
	1⅛	Rem. 209P	18.0/"Hi-Skor" 700-X	Win. WAA12	1200	9,500*
	1⅛	Win. 209	20.0/"Hi-Skor" 700-X	Fed. 12C1	1200	9,500
	1⅛	Win. 209	20.5/"Hi-Skor" 700-X	Rem. R12L	1200	8,500
	1⅛	Win. 209	20.0/"Hi-Skor" 700-X	Win. WAA12	1200	8,200
	1⅛	Fed. 209	18.0/Red Dot	Fed. 12C1	1145	8,500*
	1⅛	Fed. 209	18.0/Red Dot	Fed. 12S3	1145	8,700*
	1⅛	Fed. 209	18.5/Red Dot	Rem. R12L	1145	9,500*
	1⅛	Fed. 209	18.0/Red Dot	Rem. RXP12	1145	9,000*
	1⅛	Fed. 209	18.0/Red Dot	Win. WAA12	1145	8,500*
	1⅛	Rem. 209P	18.5/Red Dot	Fed. 12C1	1145	8,500*
Case	Shot Wgt. in Oz.	Primer	—Powder— Grains/Type	Wad	Velocity fps	Pressure LUP/psi*

Case	Shot Wgt. in Oz.	Primer	—Powder— Grains/Type	Wad	Velocity fps	Pressure LUP/psi*
Federal Paper Target (continued)	1⅛	Win. 209	18.5/Red Dot	Fed. 12C1	1145	8,500*
	1⅛	CCI 109	18.5/Red Dot	Fed. 12C1	1145	8,500*
	1⅛	CCI 209M	18.5/Red Dot	Fed. 12C1	1145	8,000*
	1⅛	Fed. 209	18.0/"Hi-Skor" 700-X	Fed. 12C1	1145	8,500
	1⅛	Fed. 209	18.0/"Hi-Skor" 700-X	Win. WAA12	1145	8,500
	1⅛	CCI 209	18.5/"Hi-Skor" 700-X	Fed. 12C1	1145	8,500
	1⅛	Rem. 209P	17.0/"Hi-Skor" 700-X	Fed. 12C1	1145	8,000
	1⅛	Rem. 209P	17.5/"Hi-Skor" 700-X	Activ L33	1145	8,500
	1	Fed. 209	20.0/Red Dot	Rem. R12L	1290	9,500*
	1	Fed. 209	21.5/Green Dot	Rem. R12L	1290	9,000*
	1	Fed. 209	20.5/Red Dot	Fed. 12S3	1290	9,000*
	1	Fed. 209	23.5/Green Dot	Fed. 12S3	1290	9,500*
	1	Fed. 209	20.5/Red Dot	Fed. 12S0	1290	10,500*
	1	Fed. 209	22.5/Green Dot	Fed. 12S0	1290	9,200*
	1	CCI 209M	21.0/Red Dot	Fed. 12S3	1290	8,700*
	1	Fed. 209	21.0/"Hi-Skor" 700-X	Fed. 12S3	1290	8,500*
Case	Shot Wgt. in Oz.	Primer	—Powder— Grains/Type	Wad	Velocity fps	Pressure LUP/psi*

Light Field

12-Gauge – 2¾″ Shells

Case	Shot Wgt. in Oz.	Primer	—Powder— Grains/Type	Wad	Velocity fps	Pressure LUP/psi*
Federal Paper Target (continued)	1	Rem. 209P	20.5/"Hi-Skor" 700-X	Fed. 12S3	1290	9,500*
	1	Rem. 209P	20.0/"Hi-Skor" 700-X	Activ T-28	1290	8,500*
	1	Rem. 209P	17.0/"Hi-Skor" 700-X	Activ L29	1200	8,500
	1	Fed. 209	18.5/"Hi-Skor" 700-X	Fed. 12S0	1200	8,500
	1	Rem. 209P	17.5/"Hi-Skor" 700-X	Fed. 12S3	1200	8,000
Federal Plastic Gold Medal	1⅛	Fed. 209	18.5/Red Dot	Fed. 12S3	1200	10,000*
	1⅛	Fed. 209	19.0/Red Dot	Rem. RXP12	1200	10,500*
	1⅛	Fed. 209	19.0/Red Dot	Win. WAA12	1200	10,000*
	1⅛	Rem. 209P	19.5/Red Dot	Fed. 12S3	1200	9,500*
	1⅛	Win. 209	19.0/Red Dot	Fed. 12S3	1200	10,500*
	1⅛	CCI 209	20.0/Red Dot	Fed. 12S3	1200	10,000*
	1⅛	CCI 209M	19.0/Red Dot	Fed. 12S3	1200	9,000*
	1⅛	Fed. 209	19.5/"Hi-Skor" 700-X	Fed. 12S3	1200	9,000
Case	Shot Wgt. in Oz.	Primer	—Powder— Grains/Type	Wad	Velocity fps	Pressure LUP/psi*

Light Field

Case	Shot Wgt. in Oz.	Primer	—Powder— Grains/Type	Wad	Velocity fps	Pressure LUP/psi*
Federal Plastic Gold Medal (continued)	1⅛	Fed. 209	19.5/"Hi-Skor" 700-X	Rem. R12L	1200	8,500
	1⅛	CCI 209	20.0/"Hi-Skor" 700-X	Rem. R12L	1200	8,000
	1⅛	Rem. 209P	18.5/"Hi-Skor" 700-X	Fed. 12S3	1200	9,000
	1⅛	Rem. 209P	18.5/"Hi-Skor" 700-X	Activ L33	1200	9,500
	1⅛	Rem. 209P	18.5/"Hi-Skor" 700-X	Rem. R12L	1200	8,500
	1⅛	Win. 209	19.5/"Hi-Skor" 700-X	Fed. 12S3	1200	8,500
	1⅛	Win. 209	19.5/"Hi-Skor" 700-X	Rem. R12L	1200	8,500
	1⅛	Win. 209	21.0/WST	Fed. 12S3	1200	9,500*
	1⅛	CCI 209	21.0/WST	Fed. 12S3	1200	10,500*
	1⅛	Fed. 209	21.5/WST	Fed. 12S3	1200	9,000*
	1⅛	Fed. 209	17.5/Red Dot	Fed. 12S3	1145	9,000*
	1⅛	Fed. 209	18.0/Red Dot	Rem. RXP12	1145	9,000*
	1⅛	Fed. 209	17.5/Red Dot	Win. WAA12	1145	9,000*
	1⅛	Rem. 209P	18.5/Red Dot	Fed. 12S3	1145	8,200*
Case	Shot Wgt. in Oz.	Primer	—Powder— Grains/Type	Wad	Velocity fps	Pressure LUP/psi*

12-Gauge — $2\frac{3}{4}$″ Shells

Case	Shot Wgt. in Oz.	Primer	—Powder— Grains/Type	Wad	Velocity fps	Pressure LUP/psi*
Federal Plastic Gold Medal (continued)	1⅛	Win. 209	17.5/Red Dot	Fed. 12S3	1145	9,500*
	1⅛	CCI 209	18.0/Red Dot	Fed. 12S3	1145	8,200*
	1⅛	CCI 209M	18.0/Red Dot	Fed. 12S3	1145	8,500*
	1⅛	Rem. 209P	17.0/"Hi-Skor" 700-X	Activ L33	1145	8,500
	1⅛	Rem. 209P	17.5/"Hi-Skor" 700-X	Rem. R12L	1145	8,000
	1⅛	Rem. 209P	16.5/"Hi-Skor" 700-X	Fed. 12S3	1145	8,000
	1⅛	CCI 209	19.5/WST	Fed. 12S3	1145	8,500*
	1⅛	Fed. 209	17.0/Red Dot	Fed. 12S3	1090	8,500*
	1⅛	Fed. 209	17.0/Red Dot	Win. WAA12	1090	8,200*
	1⅛	Win. 209	17.0/Red Dot	Fed. 12S3	1090	8,500*
	1⅛	CCI 209M	17.0/Red Dot	Fed. 12S3	1090	8,500*
	1⅛	Fio. 616	17.5/Red Dot	Fed. 12S3	1090	8,200*
	1	Fed. 209	21.0/"Hi-Skor" 700-X	Fed. 12S3	1290	9,000
	1	Win. 209	21.0/"Hi-Skor" 700-X	Fed. 12S3	1290	8,500
	1	Win. 209	23.0/WST	Fed. 12S0	1290	9,500*
Case	Shot Wgt. in Oz.	Primer	—Powder— Grains/Type	Wad	Velocity fps	Pressure LUP/psi*

Case	Shot Wgt. in Oz.	Primer	—Powder— Grains/Type	Wad	Velocity fps	Pressure LUP/psi*
Federal Plastic Gold Medal (continued)	1	CCI 209	22.5/WST	Fed. 12S0	1290	9,500*
	1	Fed. 209	23.0/WST	Fed. 12S0	1290	8,500*
	1	Win. 209	22.0/WST	Fed. 12S0	1235	8,500*
	1	CCI 209	21.0/WST	Fed. 12S0	1235	8,500*
	1	CCI 209	19.0/Red Dot	Fed. 12S0	1200	7,600*
	1	Fed. 209	18.0/"Hi-Skor" 700-X	Fed. 12S0	1180	8,000
Remington Plastic Premier Target	1⅛	Rem. 209P	19.0/Red Dot	Rem. Fig. 8	1200	10,000*
	1⅛	Rem. 209P	19.0/Red Dot	Rem. RXP12	1200	10,000*
	1⅛	Fed. 209	19.0/Red Dot	Rem. Fig. 8	1200	10,500*
	1⅛	Win. 209	19.0/Red Dot	Rem. Fig. 8	1200	10,500*
	1⅛	CCI 209M	18.5/Red Dot	Rem. Fig. 8	1200	10,500*
	1⅛	CCI 209	19.5/Red Dot	Rem. Fig. 8	1200	10,000*
	1⅛	Fio. 616	19.5/Red Dot	Rem. Fig. 8	1200	10,500*
	1⅛	Rem. 209P	19.0/"Hi-Skor" 700-X	Rem. Fig. 8	1200	10,500
	1⅛	Rem. 209P	19.0/"Hi-Skor" 700-X	Rem. RXP12	1200	10,500
	1⅛	Rem. 209P	19.0/"Hi-Skor" 700-X	Activ T32	1200	10,500
Case	Shot Wgt. in Oz.	Primer	—Powder— Grains/Type	Wad	Velocity fps	Pressure LUP/psi*

12-Gauge – 2¾″ Shells

Case	Shot Wgt. in Oz.	Primer	—Powder— Grains/Type	Wad	Velocity fps	Pressure LUP/psi*
Remington Plastic Premier Target (continued)	1⅛	Rem. 209P	19.5/"Hi-Skor" 700-X	Fed. 12C1	1200	10,500
	1⅛	Rem. 209P	19.0/"Hi-Skor" 700-X	Win. WAA12	1200	10,500
	1⅛	Fed. 209	19.0/"Hi-Skor" 700-X	Rem. Fig. 8	1200	10,500
	1⅛	Fed. 209	19.5/"Hi-Skor" 700-X	Fed. 12C1	1200	10,500
	1⅛	Win. 209	19.0/"Hi-Skor" 700-X	Rem. Fig. 8	1200	10,500
	1⅛	Win. 209	19.0/"Hi-Skor" 700-X	Win. WAA12	1200	11,000
	1⅛	Win. 209	19.5/WSL	Win. WAA12SL	1200	9,500*
	1⅛	Win. 209	19.5/WSL	Win. WAA12	1200	9,700*
	1⅛	Win. 209	19.5/WSL	Rem. RXP12	1200	9,500*
	1⅛	Win. 209	19.5/WSL	Rem. Fig. 8	1200	9,500*
	1⅛	Win. 209	19.5/WSL	Fed. 12S3	1200	10,200*
	1⅛	CCI 209	19.0/WSL	Win. WAA12SL	1200	10,000*
	1⅛	CCI 209	19.0/WSL	Win. WAA12	1200	11,000*
	1⅛	CCI 209	19.0/WSL	Rem. RXP12	1200	10,000*
Case	Shot Wgt. in Oz.	Primer	—Powder— Grains/Type	Wad	Velocity fps	Pressure LUP/psi*

Light Field

Case	Shot Wgt. in Oz.	Primer	—Powder— Grains/Type	Wad	Velocity fps	Pressure LUP/psi*
Remington Plastic Premier Target (continued)	1⅛	CCI 209	19.0/WSL	Rem. Fig. 8	1200	9,500*
	1⅛	Fed. 209	20.0/WSL	Win. WAA12SL	1200	9,000*
	1⅛	Fed. 209	19.0/WSL	Win. WAA12	1200	8,700*
	1⅛	Fed. 209	19.5/WSL	Rem. RXP12	1200	9,000*
	1⅛	Fed. 209	20.0/WSL	Rem. Fig. 8	1200	8,000*
	1⅛	Fed. 209	19.0/WSL	Fed. 12S3	1200	9,200
	1⅛	Rem. 209P	18.0/Red Dot	Rem. Fig. 8	1145	9,200*
	1⅛	Rem. 209P	18.0/Red Dot	Fed. 12S3	1145	10,000*
	1⅛	Rem. 209P	17.5/Red Dot	Rem. RXP12	1145	9,000*
	1⅛	Rem. 209P	17.0/Red Dot	Win. WAA12	1145	10,000*
	1⅛	Fed. 209	17.5/Red Dot	Rem. Fig. 8	1145	9,000*
	1⅛	Win. 209	18.0/Red Dot	Rem. Fig. 8	1145	9,500*
	1⅛	CCI 209M	17.5/Red Dot	Rem. Fig. 8	1145	9,500*
	1⅛	CCI 209	17.5/Red Dot	Rem. Fig. 8	1145	8,500*
	1⅛	Fio. 616	17.5/Red Dot	Rem. Fig. 8	1145	9,000*
	1⅛	Rem. 209P	17.5/"Hi-Skor" 700-X	Rem. Fig. 8	1145	9,500
	1⅛	Rem. 209P	17.5/"Hi-Skor" 700-X	Rem. RXP12	1145	9,500
Case	Shot Wgt. in Oz.	Primer	—Powder— Grains/Type	Wad	Velocity fps	Pressure LUP/psi*

12-Gauge — 2¾″ Shells

Case	Shot Wgt. in Oz.	Primer	—Powder— Grains/Type	Wad	Velocity fps	Pressure LUP/psi*
Remington Plastic Premier Target (continued)	1⅛	Rem. 209P	17.5/"Hi-Skor" 700-X	Activ T32	1145	9,500
	1⅛	Rem. 209P	18.5/"Hi-Skor" 700-X	Fed. 12C1	1145	9,000*
	1⅛	Rem. 209P	17.5/"Hi-Skor" 700-X	Win. WAA12	1145	10,000*
	1⅛	Fed. 209	17.5/"Hi-Skor" 700-X	Rem. Fig. 8	1145	9,500
	1⅛	Fed. 209	18.0/"Hi-Skor" 700-X	Fed. 12C1	1145	9,500*
	1⅛	Win. 209	17.5/"Hi-Skor" 700-X	Rem. Fig. 8	1145	9,500*
	1⅛	Win. 209	17.5/"Hi-Skor" 700-X	Win. WAA12	1145	10,000*
	1⅛	Win. 209	18.5/WSL	Win. WAA12	1145	8,500*
	1⅛	CCI 209	18.0/WSL	Win. WAA12	1145	9,000*
	1⅛	CCI 209	18.0/WSL	Fed. 12S3	1145	8,500*
	1⅛	Fed. 209	18.5/WSL	Win. WAA12SL	1145	8,000*
	1⅛	Fed. 209	18.0/WSL	Win. WAA12	1145	8,500*
	1⅛	Fed. 209	18.5/WSL	Fed. 12S3	1145	8,500*
Case	Shot Wgt. in Oz.	Primer	—Powder— Grains/Type	Wad	Velocity fps	Pressure LUP/psi*

Case	Shot Wgt. in Oz.	Primer	—Powder— Grains/Type	Wad	Velocity fps	Pressure LUP/psi*
Remington Plastic Premier Target (continued)	1⅛	Win. 209	19.0/WST	Rem. RXP12	1145	10,500*
	1⅛	Win. 209	19.0/WST	Rem. Fig. 8	1145	10,500*
	1⅛	CCI 209	18.0/WST	Win. WAA12	1145	11,000*
	1⅛	CCI 209	18.5/WST	Rem. RXP12	1145	11,000*
	1⅛	CCI 209	18.5/WST	Rem. Fig. 8	1145	10,000*
	1⅛	Fed. 209	18.5/WST	Rem. RXP12	1145	10,000*
	1⅛	Fed. 209	18.5/WST	Rem. Fig. 8	1145	10,200*
	1⅛	Rem. 209P	16.5/Red Dot	Rem. Fig. 8	1090	8,500*
	1⅛	Rem. 209P	16.0/Red Dot	Rem. RXP12	1090	8,700*
	1⅛	Rem. 209P	16.0/Red Dot	Fed. 12S3	1090	10,500*
	1⅛	Rem. 209P	16.0/Red Dot	Win. WAA12	1090	9,500*
	1⅛	Fed. 209	16.0/Red Dot	Rem. Fig. 8	1090	10,000*
	1⅛	Win. 209	16.5/Red Dot	Rem. Fig. 8	1090	9,000*
	1⅛	CCI 209M	16.5/Red Dot	Rem. Fig. 8	1090	9,000*
	1⅛	Fio. 616	16.5/Red Dot	Rem. Fig. 8	1090	9,000*
	1	Rem. 209P	21.5/Red Dot	Rem. Fig. 8	1290	9,000*
	1	Rem. 209P	22.0/Green Dot	Rem. Fig. 8	1290	8,000*
	1	Rem. 209P	20.5/Red Dot	Rem. R12L	1290	10,000*
	1	Rem. 209P	20.5/Red Dot	Win. WAA12F1	1290	9,000*
	1	Rem. 209P	20.0/Red Dot	Fed. 12S0	1290	10,500*
Case	Shot Wgt. in Oz.	Primer	—Powder— Grains/Type	Wad	Velocity fps	Pressure LUP/psi*

12-Gauge — 2¾″ Shells

Case	Shot Wgt. in Oz.	Primer	—Powder— Grains/Type	Wad	Velocity fps	Pressure LUP/psi*
Remington Plastic Premier Target (continued)	1	Rem. 209P	22.0/Green Dot	Fed. 12S0	1290	8,700*
	1	Fed. 209	20.5/Red Dot	Rem. R12L	1290	10,500*
	1	Fed. 209	22.5/Green Dot	Rem. R12L	1290	9,200*
	1	Win. 209	20.0/Red Dot	Rem. R12L	1290	10,000*
	1	Win. 209	22.0/Green Dot	Rem. R12L	1290	8,700*
	1	CCI 209M	20.0/Red Dot	Rem. R12L	1290	10,500*
	1	CCI 209M	22.0/Green Dot	Rem. R12L	1290	9,000*
	1	Rem. 209P	18.0/Red Dot	Rem. Fig. 8	1200	8,500*
	1	Rem. 209P	18.0/Red Dot	Fed. 12S0	1200	9,000*
	1	CCI 209M	17.5/Red Dot	Rem. Fig. 8	1200	9,000*
	1	Fed. 209	18.0/Red Dot	Rem. Fig. 8	1200	8,500*
	1	Win. 209	19.0/WST	Fed. 12S0	1180	8,200*
	1	CCI 209	19.0/WST	Win. WAA12SL	1180	8,000*
	1	CCI 209	18.5/WST	Fed. 12S0	1180	9,000*
Remington Plastic Unibody	1	CCI 209	21.0/Red Dot	Rem. R12L	1290	9,700*
	1	CCI 209	23.5/Green Dot	Rem. R12L	1290	8,000*
	1	CCI 209M	20.0/Red Dot	Rem. R12L	1290	10,500*
	1	CCI 209M	22.5/Green Dot	Rem. R12L	1290	8,000*
Case	Shot Wgt. in Oz.	Primer	—Powder— Grains/Type	Wad	Velocity fps	Pressure LUP/psi*

Case	Shot Wgt. in Oz.	Primer	—Powder— Grains/Type	Wad	Velocity fps	Pressure LUP/psi*
Remington Plastic Unibody (continued)	1	Fed. 209	19.5/Red Dot	Rem. R12L	1290	10,500*
	1	Fed. 209	22.0/Green Dot	Rem. R12L	1290	9,500*
	1	Win. 209	20.0/Red Dot	Rem. R12L	1290	10,700*
	1	Win. 209	21.5/Green Dot	Rem. R12L	1290	9,000*
Winchester Plastic AA Compression Formed	1⅛	Win. 209	18.5/Red Dot	Fed. 12C1	1200	9,700*
	1⅛	Win. 209	19.0/Red Dot	Fed. 12C2	1200	8,500*
	1⅛	Win. 209	18.5/Red Dot	Rem. R12H	1200	9,500*
	1⅛	Win. 209	18.5/Red Dot	Rem. RXP12	1200	10,000*
	1⅛	Win. 209	18.0/Red Dot	Win. WAA12	1200	10,500*
	1⅛	Fed. 209	17.5/Red Dot	Win. WAA12	1200	10,500*
	1⅛	Rem. 209P	19.0/Red Dot	Win. WAA12	1200	9,500*
	1⅛	CCI 109	18.0/Red Dot	Win. WAA12	1200	10,500*
	1⅛	CCI 209M	18.5/Red Dot	Win. WAA12	1200	10,500*
	1⅛	Fio. 616	18.0/Red Dot	Win. WAA12	1200	10,500*
	1⅛	Win. 209	19.0/"Hi-Skor" 700-X	Win. WAA12	1200	9,200
	1⅛	Win. 209	19.0/"Hi-Skor" 700-X	Fed. 12S1	1200	8,500
	1⅛	Win. 209	19.0/"Hi-Skor" 700-X	Rem. RXP12	1200	9,000
Case	Shot Wgt. in Oz.	Primer	—Powder— Grains/Type	Wad	Velocity fps	Pressure LUP/psi*

Light Field

12-Gauge – $2^3/_4$″ Shells

Case	Shot Wgt. in Oz.	Primer	—Powder— Grains/Type	Wad	Velocity fps	Pressure LUP/psi*
Winchester Plastic AA Compression Formed (continued)	1⅛	Fed. 209	19.0/"Hi-Skor" 700-X	Win. WAA12	1200	10,000
	1⅛	Fed. 209	18.5/"Hi-Skor" 700-X	Fed. 12S1	1200	10,000
	1⅛	Fed. 209	19.0/"Hi-Skor" 700-X	Rem. RXP12	1200	9,500
	1⅛	CCI 209	19.0/"Hi-Skor" 700-X	Win. WAA12	1200	10,200
	1⅛	CCI 209	19.0/"Hi-Skor" 700-X	Fed. 12S1	1200	9,000
	1⅛	CCI 209	19.0/"Hi-Skor" 700-X	Rem. RXP12	1200	9,000*
	1⅛	Rem. 209P	17.5/"Hi-Skor" 700-X	Win. WAA12	1200	9,000
	1⅛	Rem. 209P	18.5/"Hi-Skor" 700-X	Activ T35	1200	9,500
	1⅛	Rem. 209P	18.0/"Hi-Skor" 700-X	Fed. 12S1	1200	9,200
	1⅛	Rem. 209P	18.0/"Hi-Skor" 700-X	Rem. RXP12	1200	9,700
	1⅛	Rem. 209P	18.5/"Hi-Skor" 700-X	Rem. Fig. 8	1200	10,500
Case	Shot Wgt. in Oz.	Primer	—Powder— Grains/Type	Wad	Velocity fps	Pressure LUP/psi*

Case	Shot Wgt. in Oz.	Primer	—Powder— Grains/Type	Wad	Velocity fps	Pressure LUP/psi*
Winchester Plastic AA Compressiom Formed (continued)	1⅛	Win. 209	20.0/WST	Win. WAA12	1200	10,000*
	1⅛	Win. 209	20.0/WST	Rem. RXP12	1200	9,700*
	1⅛	Win. 209	20.5/WST	Rem. Fig. 8	1200	10,000*
	1⅛	Win. 209	20.0/WST	Fed. 12S3	1200	11,000*
	1⅛	CCI 209	20.5/WST	Win. WAA12	1200	10,500*
	1⅛	CCI 209	20.5/WST	Rem. RXP12	1200	10,500*
	1⅛	CCI 209	20.5/WST	Rem. Fig. 8	1200	10,000*
	1⅛	CCI 209	20.5/WST	Fed. 12S3	1200	11,000*
	1⅛	Fed. 209	20.5/WST	Win. WAA12	1200	10,000*
	1⅛	Fed. 209	21.0/WST	Rem. RXP12	1200	10,000*
	1⅛	Fed. 209	21.0/WST	Rem. Fig. 8	1200	9,200*
	1⅛	Fed. 209	21.0/WST	Fed. 12S3	1200	11,000*
	1⅛	Win. 209	20.0/WSL	Win. WAA12SL	1200	9,000*
	1⅛	Win. 209	20.0/WSL	Win. WAA12	1200	10,000*
	1⅛	Win. 209	19.5/WSL	Rem. RXP12	1200	10,000*
	1⅛	Win. 209	20.0/WSL	Rem. Fig. 8	1200	9,500*
	1⅛	Win. 209	20.0/WSL	Fed. 12S3	1200	10,200*
	1⅛	CCI 209	19.5/WSL	Win. WAA12SL	1200	10,000*
	1⅛	CCI 209	19.5/WSL	Win. WAA12	1200	11,000*
Case	Shot Wgt. in Oz.	Primer	—Powder— Grains/Type	Wad	Velocity fps	Pressure LUP/psi*

12-Gauge — 2¾″ Shells

Case	Shot Wgt. in Oz.	Primer	—Powder— Grains/Type	Wad	Velocity fps	Pressure LUP/psi*
Winchester Plastic AA Compression Formed (continued)	1⅛	CCI 209	19.5/WSL	Rem. Fig. 8	1200	9,700*
	1⅛	CCI 209	19.5/WSL	Rem. R12L	1200	9,200*
	1⅛	CCI 209	19.5/WSL	Fed. 12S3	1200	10,500*
	1⅛	Fed. 209	20.0/WSL	Win. WAA12SL	1200	9,000*
	1⅛	Fed. 209	20.0/WSL	Win. WAA12	1200	10,700*
	1⅛	Fed. 209	20.0/WSL	Rem. RXP12	1200	9,700*
	1⅛	Fed. 209	20.0/WSL	Rem. Fig. 8	1200	9,500*
	1⅛	Fed. 209	20.0/WSL	Fed. 12S3	1200	10,500*
	1⅛	Win. 209	17.5/Red Dot	Fed. 12C1	1145	9,500*
	1⅛	Win. 209	17.5/Red Dot	Fed. 12C2	1145	8,000*
	1⅛	Win. 209	17.0/Red Dot	Rem. R12H	1145	8,500*
	1⅛	Win. 209	17.0/Red Dot	Rem. RXP12	1145	8,500*
	1⅛	Win. 209	17.0/Red Dot	Win. WAA12	1145	10,000*
	1⅛	Win. 209	16.5/Red Dot	Activ T32	1145	9,500*
	1⅛	Fed. 209	17.0/Red Dot	Win. WAA12	1200	10,000*
	1⅛	Rem. 209P	17.5/Red Dot	Win. WAA12	1200	8,500*
	1⅛	CCI 109	17.0/Red Dot	Win. WAA12	1200	9,200*
	1⅛	CCI 209M	17.5/Red Dot	Win. WAA12	1200	10,500*
Case	Shot Wgt. in Oz.	Primer	—Powder— Grains/Type	Wad	Velocity fps	Pressure LUP/psi*

Case	Shot Wgt. in Oz.	Primer	—Powder— Grains/Type	Wad	Velocity fps	Pressure LUP/psi*
Winchester Plastic AA Compression Formed (continued)	1⅛	Fio. 616	17.0/Red Dot	Win. WAA12	1200	10,200*
	1⅛	Win. 209	17.5/"Hi-Skor" 700-X	Win. WAA12	1145	8,000
	1⅛	Win. 209	18.0/"Hi-Skor" 700-X	Fed. 12S1	1145	8,000
	1⅛	Win. 209	18.0/"Hi-Skor" 700-X	Rem. RXP12	1145	8,500
	1⅛	Fed. 209	17.5/"Hi-Skor" 700-X	Win. WAA12	1145	9,500
	1⅛	Fed. 209	17.0/"Hi-Skor" 700-X	Fed. 12S1	1145	8,500
	1⅛	Fed. 209	18.0/"Hi-Skor" 700-X	Rem. RXP12	1145	8,500
	1⅛	CCI 209	17.5/"Hi-Skor" 700-X	Win. WAA12	1145	8,500
	1⅛	CCI 209	17.5/"Hi-Skor" 700-X	Fed. 12S1	1145	8,500
	1⅛	CCI 209	17.5/"Hi-Skor" 700-X	Rem. RXP12	1145	8,500
	1⅛	Rem. 209P	16.0/"Hi-Skor" 700-X	Win. WAA12	1145	8,500
	1⅛	Rem. 209P	17.0/"Hi-Skor" 700-X	Activ T35	1145	8,500
Case	Shot Wgt. in Oz.	Primer	—Powder— Grains/Type	Wad	Velocity fps	Pressure LUP/psi*

12-Gauge — 2¾″ Shells

Case	Shot Wgt. in Oz.	Primer	—Powder— Grains/Type	Wad	Velocity fps	Pressure LUP/psi*
Winchester Plastic AA Compression Formed (continued)	1⅛	Rem. 209P	17.0/"Hi-Skor" 700-X	Fed. 12S1	1145	8,500
	1⅛	Rem. 209P	17.0/"Hi-Skor" 700-X	Rem. Fig. 8	1145	9,500
	1⅛	Win. 209	18.5/WSL	Win. WAA12SL	1145	8,000*
	1⅛	Win. 209	19.0/WSL	Rem. Fig. 8	1145	8,500*
	1⅛	CCI 209	18.5/WSL	Win. WAA12SL	1145	9,000*
	1⅛	CCI 209	18.5/WSL	Rem. Fig. 8	1145	8,500*
	1⅛	Fed. 209	19.0/WSL	Rem. RXP12	1145	8,000*
	1⅛	Fed. 209	19.0/WSL	Rem. Fig. 8	1145	8,200*
	1⅛	Fed. 209	19.0/WSL	Fed. 12S3	1145	8,000*
	1⅛	Win. 209	18.5/WST	Win. WAA12	1145	8,500*
	1⅛	Win. 209	19.0/WST	Rem. RXP12	1145	8,700*
	1⅛	Win. 209	19.0/WST	Rem. Fig. 8	1145	8,500*
	1⅛	Win. 209	19.0/WST	Fed. 12S3	1145	10,000*
	1⅛	CCI 209	19.0/WST	Win. WAA12	1145	9,000*
	1⅛	CCI 209	19.5/WST	Rem. RXP12	1145	9,000*
	1⅛	CCI 209	19.0/WST	Rem Fig 8	1145	9,000*
	1⅛	CCI 209	19.0/WST	Fed. 12S3	1145	9,500*
Case	Shot Wgt. in Oz.	Primer	—Powder— Grains/Type	Wad	Velocity fps	Pressure LUP/psi*

Light Field

Case	Shot Wgt. in Oz.	Primer	—Powder— Grains/Type	Wad	Velocity fps	Pressure LUP/psi*
Winchester Plastic AA Compression Formed (continued)	1⅛	Fed. 209	19.0/WST	Win. WAA12	1145	9,000*
	1⅛	Fed. 209	19.5/WST	Rem. Fig. 8	1145	8,000*
	1⅛	Fed. 209	19.5/WST	Fed. 12S3	1145	10,000*
	1⅛	Win. 209	16.0/Red Dot	Win. WAA12	1090	9,500*
	1⅛	Win. 209	17.0/Red Dot	Fed. 12S3	1090	10,500*
	1⅛	Win. 209	16.5/Red Dot	Rem. RXP12	1090	9,000*
	1⅛	Win. 209	16.0/Red Dot	Activ T32	1090	8,500*
	1⅛	Fed. 209	16.0/Red Dot	Win. WAA12	1090	10,000*
	1⅛	Rem. 209P	17.0/Red Dot	Win. WAA12	1090	8,000*
	1⅛	CCI 209M	17.0/Red Dot	Win. WAA12	1090	10,000*
	1⅛	Fio. 616	16.0/Red Dot	Win. WAA12	1090	9,000*
	1	Win. 209	20.0/Red Dot	Fed. 12C1	1290	10,200*
	1	Win. 209	21.0/Green Dot	Fed. 12C1	1290	9,000*
	1	Win. 209	20.0/Red Dot	Fed. 12S3	1290	10,000*
	1	Win. 209	22.5/Green Dot	Fed. 12S3	1290	9,700*
	1	Win. 209	20.0/Red Dot	Rem. RXP12	1290	10,000*
	1	Win. 209	21.0/Green Dot	Rem. RXP12	1290	9,000*
	1	Win. 209	19.0/Red Dot	Win. WAA12	1290	10,500*
	1	Win. 209	20.0/Green Dot	Win. WAA12	1290	8,700*
	1	CCI 209M	18.5/Red Dot	Win. WAA12	1290	10,500*
Case	Shot Wgt. in Oz.	Primer	—Powder— Grains/Type	Wad	Velocity fps	Pressure LUP/psi*

12-Gauge – $2^3/_4$″ Shells

Case	Shot Wgt. in Oz.	Primer	—Powder— Grains/Type	Wad	Velocity fps	Pressure LUP/psi*
Winchester Plastic AA Compression Formed (continued)	1	CCI 209M	21.5/Green Dot	Win. WAA12	1290	10,000*
	1	Win. 209	21.0/"Hi-Skor" 700-X	Fed. 12S1	1290	9,000
	1	Fed. 209	20.5/"Hi-Skor" 700-X	Fed. 12S1	1290	8,500
	1	Win. 209	22.0/WST	Win. WAA12SL	1290	9,000*
	1	Win. 209	22.0/WST	Fed. 12S0	1290	11,000*
	1	CCI 209	22.5/WST	Win. WAA12SL	1290	9,500*
	1	CCI 209	21.5/WST	Fed. 12S0	1290	10,700*
	1	Fed. 209	22.5/WST	Win. WAA12SL	1290	8,500*
	1	Fed. 209	22.5/WST	Fed. 12S0	1290	10,700*
	1	Win. 209	21.0/WSL	Win. WAA12SL	1290	9,500*
	1	Win. 209	21.5/WSL	Fed. 12S0	1290	10,000*
	1	CCI 209	21.0/WSL	Win. WAA12SL	1290	9,500*
	1	CCI 209	21.0/WSL	Fed. 12S0	1290	10,500*
	1	Fed. 209	21.0/WSL	Win. WAA12SL	1290	9,500*
	1	Fed. 209	21.5/WSL	Fed. 12S0	1290	9,500*
	1	Win. 209	21.0/WST	Win. WAA12SL	1235	8,000*
	1	Win. 209	20.5/WST	Fed. 12S0	1235	9,500*
	1	CCI 209	20.5/WST	Fed. 12S0	1235	9,500*
Case	Shot Wgt. in Oz.	Primer	—Powder— Grains/Type	Wad	Velocity fps	Pressure LUP/psi*

Case	Shot Wgt. in Oz.	Primer	—Powder— Grains/Type	Wad	Velocity fps	Pressure LUP/psi*
Winchester Plastic AA Compression Formed (continued)	1	Fed. 209	21.0/WST	Fed. 12S0	1235	9,500*
	1	Win. 209	18.0/Red Dot	Fed. 12S0	1200	9,500*
	1	Win. 209	18.0/Red Dot	Fed. 12S1	1200	8,500*
	1	Win. 209	18.0/Red Dot	Rem. RXP12	1200	8,500*
	1	Win. 209	18.0/Red Dot	Win. WAA12	1200	9,000*
	1	Win. 209	18.0/Red Dot	Win. WAA12F1	1200	9,000*
	1	CCI 209M	17.5/Red Dot	Win. WAA12	1200	10,000*
	1	Win. 209	17.5/"Hi-Skor" 700-X	Win. WAA12F1	1200	8,500
	1	Win. 209	17.0/"Hi-Skor" 700-X	Fed. 12S0	1200	9,700
	1	Fed. 209	17.0/"Hi-Skor" 700-X	Win. WAA12F1	1200	9,000
	1	Fed. 209	17.5/"Hi-Skor" 700-X	Fed. 12S0	1200	10,000
	1	Win. 209	19.0/WST	Fed. 12S0	1180	8,000*
	1	CCI 209	19.0/WST	Fed. 12S0	1180	8,500*
	1	Win. 209	16.5/"Hi-Skor" 700-X	Fed. 12S0	1145	9,000
	1	Fed. 209	16.0/"Hi-Skor" 700-X	Win. WAA12F1	1145	8,500
Case	Shot Wgt. in Oz.	Primer	—Powder— Grains/Type	Wad	Velocity fps	Pressure LUP/psi*

12-Gauge — 2¾″ Shells

Case	Shot Wgt. in Oz.	Primer	—Powder— Grains/Type	Wad	Velocity fps	Pressure LUP/psi*
Winchester Plastic AA Compression Formed (continued)	1	Fed. 209	16.5/"Hi-Skor" 700-X	Fed. 12S0	1145	9,500
	7/8***	Win. 209	18.0/Red Dot	Fed. 12S0	1200	8,000*
Activ Plastic	1⅛	CCI 209	20.0/Red Dot	Fed. 12S0	1200	8,200*
	1⅛	CCI 209M	19.5/Red Dot	Fed. 12S0	1200	10,000*
	1⅛	Fed. 209	19.5/Red Dot	Fed. 12S0	1200	9,500*
	1⅛	Win. 209	19.5/Red Dot	Fed. 12S0	1200	10,000*
	1⅛	Win. 209	19.5/Red Dot	Fed. 12S3	1200	10,500*
	1⅛	Win. 209	19.5/Red Dot	Win. WAA12F1	1200	8,700*
	1⅛	Fed. 209	19.5/"Hi-Skor" 700-X	Activ L33	1200	9,000
	1⅛	Rem. 209P	19.0/"Hi-Skor" 700-X	Activ L33	1200	10,000
	1⅛	Win. 209	19.5/"Hi-Skor" 700-X	Activ L33	1200	8,000
	1⅛	CCI 209M	17.5/Red Dot	Fed. 12S0	1145	8,000*
	1⅛	Fed. 209	18.0/Red Dot	Fed. 12S0	1145	8,700*
	1⅛	Win. 209	18.5/Red Dot	Fed. 12S0	1145	9,000*
	1⅛	Win. 209	18.0/Red Dot	Fed. 12S3	1145	8,500*
Case	Shot Wgt. in Oz.	Primer	—Powder— Grains/Type	Wad	Velocity fps	Pressure LUP/psi*

Case	Shot Wgt. in Oz.	Primer	—Powder— Grains/Type	Wad	Velocity fps	Pressure LUP/psi*
Activ Plastic (continued)	1⅛	Rem. 209P	17.5/"Hi-Skor" 700-X	Activ L33	1145	8,500
	1	Rem. 209P	18.0/"Hi-Skor" 700-X	Activ L29	1200	8,000
Fiocchi Plastic	1⅛	Fio. 616	20.0/Red Dot	Fed. 12S3	1200	9,000*
	1⅛	CCI 209M	18.5/Red Dot	Rem. RXP12	1200	9,500*
	1⅛	Rem. 209P	19.0/"Hi-Skor" 700-X	Rem. RXP12	1200	9,500
	1⅛	Rem. 209P	19.5/"Hi-Skor" 700-X	Win. WAA12	1200	10,000
	1⅛	Fed. 209	18.0/Red Dot	Fed. 12S3	1145	9,000*
	1⅛	Rem. 209P	17.5/"Hi-Skor" 700-X	Rem. RXP12	1200	9,000
	1⅛	Rem. 209P	17.5/"Hi-Skor" 700-X	Win. WAA12	1200	9,700
Case	Shot Wgt. in Oz.	Primer	—Powder— Grains/Type	Wad	Velocity fps	Pressure LUP/psi*

CW/BSC = Card wad inserted into bottom of shot cup. * This load may not function in some semi-automatic shotguns.

16-Gauge — $2^3/_4$″ Shells

Case	Shot Wgt. in Oz.	Primer	—Powder— Grains/Type	Wad	Velocity fps	Pressure LUP/psi*
Federal Plastic Hi Power Paper Base Wad	1⅛	Fed. 209	19.0/Green Dot	Rem. SP16	1185	10,500*
	1⅛	Fed. 209	21.5/Unique	Rem. SP16	1185	9,000*
	1⅛	Fed. 209	22.0/Herco	Rem. SP16	1185	9,000*
	1⅛	Fed. 209	18.5/Green Dot	Win. WAA16	1185	10,200*
	1⅛	Fed. 209	21.0/Unique	Win. WAA16	1185	8,700*
	1⅛	Fed. 209	22.0/Herco	Win. WAA16	1185	9,000*
	1	Fed. 209	23.0/Unique	Win. WAA16	1275	9,000*
	1	Fed. 209	23.5/Herco	Win. WAA16	1275	8,700*
	1	Fed. 209	23.0/Unique	Activ G28	1275	9,000*
	1	Fed. 209	23.5/Herco	Activ G28	1275	8,500*
	1	Fed. 209	19.0/Green Dot	Win. WAA16	1220	10,000*
	1	Fed. 209	21.0/Unique	Win. WAA16	1220	8,500*
	1	Fed. 209	21.5/Herco	Win. WAA16	1220	8,000*
	1	Fed. 209	18.5/Green Dot	Activ G28	1220	9,500*
	1	Fed. 209	21.5/Unique	Activ G28	1220	8,200*
	1	Fed. 209	21.5/Herco	Activ G28	1220	8,000*
Remington Plastic SP Plastic Base Wad	1⅛	Rem. 209P	20.0/Unique	Win. WAA16	1185	10,500*
	1⅛	Rem. 209P	21.0/Herco	Win. WAA16	1185	10,500*
	1⅛	Rem. 209P	20.5/Unique	Activ G28	1185	10,700*
Case	Shot Wgt. in Oz.	Primer	—Powder— Grains/Type	Wad	Velocity fps	Pressure LUP/psi*

Light Field

Case	Shot Wgt. in Oz.	Primer	—Powder— Grains/Type	Wad	Velocity fps	Pressure LUP/psi*
Remington Plastic SP Plastic Base Wad	1⅛	Rem. 209P	21.0/Herco	Activ G28	1185	10,500*
	1	Rem. 209P	21.0/Unique	Win. WAA16	1275	10,200*
	1	Rem. 209P	22.0/Herco	Win. WAA16	1275	10,000*
	1	Rem. 209P	21.0/Unique	Activ G28	1275	10,200*
	1	Rem. 209P	22.0/Herco	Activ G28	1275	10,000*
	1	Rem. 209P	20.0/Unique	Win. WAA16	1220	9,500*
	1	Rem. 209P	21.0/Herco	Win. WAA16	1220	9,700*
	1	Rem. 209P	20.5/Unique	Activ G28	1220	8,500*
	1	Rem. 209P	21.0/Herco	Activ G28	1220	9,000*
Winchester Plastic Compression Formed	1⅛	Win. 209	27.0/Blue Dot	Rem. SP16	1185	10,000*
	1⅛	Win. 209	20.0/"Hi-Skor" 800-X	Rem. SP16	1185	9,000
	1⅛	Fed. 209	20.5/SR 7625	Rem. SP16	1185	10,000
	1⅛	Win. 209	24.0/SR 4756	Rem. SP16	1185	9,000
	1⅛	Fed. 209	23.0/SR 4756	Rem. SP16	1185	9,500
	1⅛	Win. 209	21.0/SR 7625	Rem. SP16	1185	10,000
	1⅛	Win. 209	26.5/540	Rem. SP16	1185	9,000
	1⅛	CCI 109	26.5/540	Rem. SP16	1185	8,500
	1⅛	CCI 209	20.5/WSF	Win. WAA16	1185	11,000*
	1⅛	Win. 209	24.5/540	Win. WAA16	1185	11,000*
Case	Shot Wgt. in Oz.	Primer	—Powder— Grains/Type	Wad	Velocity fps	Pressure LUP/psi*

16-Gauge – 2¾″ Shells

Case	Shot Wgt. in Oz.	Primer	—Powder— Grains/Type	Wad	Velocity fps	Pressure LUP/psi*
Winchester Plastic Compression Formed (continued)	1⅛	Fed. 209	24.0/540	Win. WAA16	1185	10,500*
	1⅛	CCI 209	24.5/540	Win. WAA16	1185	10,500*
	1⅛	Win. 209	26.0/571	Win. WAA16	1185	10,200*
	1⅛	Fed. 209	25.5/571	Win. WAA16	1185	10,200*
	1⅛	CCI 209	26.0/571	Win. WAA16	1185	10,000*
	1	Win. 209	29.0/Blue Dot	Rem. SP16	1275	9,500*
	1	Win. 209	19.5/Unique	Win. WAA16	1220	10,500*
	1	Win. 209	20.0/Herco	Win. WAA16	1220	10,200*
	1	Win. 209	20.0/Herco	Activ G28	1220	10,000*
	1	Win. 209	21.0/WSF	Win. WAA16	1220	9,000*
	1	Fed. 209	21.5/WSF	Win. WAA16	1220	8,500*
	1	CCI 209	21.0/WSF	Win. WAA16	1220	9,000*
	1	Win. 209	24.0/540	Win. WAA16	1220	9,500*
	1	Fed. 209	24.0/540	Win. WAA16	1220	9,500*
	1	CCI 209	24.5/540	Win. WAA16	1220	9,000*
	1	Win. 209	26.5/571	Win. WAA16	1220	9,500*
	1	Fed. 209	26.0/571	Win. WAA16	1220	9,500*
	1	CCI 209	26.5/571	Win. WAA16	1220	9,000*
Activ Plastic	1⅛	CCI 209	20.5/Unique	Win. WAA16	1185	9,200*
Case	Shot Wgt. in Oz.	Primer	—Powder— Grains/Type	Wad	Velocity fps	Pressure LUP/psi*

Case	Shot Wgt. in Oz.	Primer	—Powder— Grains/Type	Wad	Velocity fps	Pressure LUP/psi*
Activ Plastic (continued)	1⅛	CCI 209	22.0/Herco	Win. WAA16	1185	9,500*
	1⅛	CCI 209	19.0/Green Dot	Rem. SP16	1185	10,500*
	1⅛	CCI 209	21.5/Unique	Rem. SP16	1185	9,200*
	1⅛	CCI 209	22.0/Herco	Rem. SP16	1185	9,000*
	1	CCI 209	23.0/Unique	Activ G28	1275	9,000*
	1	CCI 209	24.5/Herco	Activ G28	1275	8,700*
	1	CCI 209	22.5/Unique	Win. WAA16	1275	8,700*
	1	CCI 209	24.0/Herco	Win. WAA16	1275	9,000*
	1	CCI 209	19.5/Green Dot	Activ G28	1220	10,000*
	1	CCI 209	21.5/Unique	Activ G28	1220	8,700*
	1	CCI 209	23.0/Herco	Activ G28	1220	8,500*
	1	CCI 209	19.5/Green Dot	Win. WAA16	1220	9,700*
	1	CCI 209	21.5/Unique	Win. WAA16	1220	8,500*
	1	CCI 209	22.5/Herco	Win. WAA16	1220	8,000*
	1	CCI 209	16.5/Red Dot	Activ G28	1165	10,000*
	1	CCI 209	18.0/Green Dot	Activ G28	1165	9,200*
	1	CCI 209	20.0/Unique	Activ G28	1165	8,000*
Fiocchi Plastic	1⅛	Fio. 616	19.5/Unique	Win. WAA16	1185	10,500*
	1⅛	Fio. 616	20.5/Unique	Rem. SP16	1185	10,000*
	1⅛	Fio. 616	21.0/Herco	Rem. SP16	1185	10,200*
Case	Shot Wgt. in Oz.	Primer	—Powder— Grains/Type	Wad	Velocity fps	Pressure LUP/psi*

16-Gauge — 2¾″ Shells

Case	Shot Wgt. in Oz.	Primer	—Powder— Grains/Type	Wad	Velocity fps	Pressure LUP/psi*
Fiocchi Plastic (continued)	1	Fio. 616	21.5/Unique	Activ G28	1275	9,500*
	1	Fio. 616	22.0/Herco	Activ G28	1275	9,000*
	1	Fio. 616	21.0/Unique	Win. WAA16	1275	10,000*
	1	Fio. 616	22.0/Herco	Win. WAA16	1275	9,500*
	1	Fio. 616	20.0/Unique	Activ G28	1220	9,000*
	1	Fio. 616	21.0/Herco	Activ G28	1220	8,500*
	1	Fio. 616	18.0/Green Dot	Win. WAA16	1220	10,500*
	1	Fio. 616	20.5/Unique	Win. WAA16	1220	9,000*
	1	Fio. 616	21.0/Herco	Win. WAA16	1220	9,000*
	1	Fio. 616	15.5/Red Dot	Win. WAA16	1165	10,500*
	1	Fio. 616	17.5/Green Dot	Win. WAA16	1165	9,500*
	1	Fio. 616	19.0/Unique	Win. WAA16	1165	8,000*
	1	Fio. 616	17.0/Red Dot	Activ G28	1165	10,000*
	1	Fio. 616	18.0/Green Dot	Activ G28	1165	8,200*
	1	Fio. 616	19.5/Unique	Activ G28	1165	8,000*
Case	Shot Wgt. in Oz.	Primer	—Powder— Grains/Type	Wad	Velocity fps	Pressure LUP/psi*

20-Gauge — 2¾″ Shells

Case	Shot Wgt. in Oz.	Primer	—Powder— Grains/Type	Wad	Velocity fps	Pressure LUP/psi*
Federal Paper Target	1	Win. 209	22.5/SR 4756	Win. WAA20F1	1220	10,000
	1	Fed. 209	21.5/SR 4756	Rem. SP20	1220	10,500
	1	Fed. 209	17.0/Herco	Rem. RXP20	1165	11,500*
	1	Fed. 209	16.5/Herco	Rem. SP20	1165	11,500*
	1	Fed. 209	16.0/Herco	Win. WAA20	1165	11,200*
	1	Fed. 209	16.5/Herco	Win. WAA20F1	1165	11,500*
	1	Fed. 209	20.5/SR 4756	Win. WAA20F1	1165	9,500
	1	Fed. 209	20.5/SR 4756	Rem. SP20	1165	9,500
	¾**	Fed. 209	15.5/Unique	Fed. 20S1	1200	9,200*
	¾**	Fed. 209	15.5/Unique	Win. WAA20	1200	9,200*
Federal Plastic Target	1	CCI 209M	18.5/Herco	Fed. 20S1	1220	10,000*
	1	Fed. 209	22.0/Blue Dot	Rem. SP20	1220	11,000*
	1	Fed. 209	23.0/Blue Dot	Win. WAA20F1	1220	11,000*
	1	Fed. 209	18.5/"Hi-Skor" 800-X	Fed. 20S1	1220	10,500
	1	Fed. 209	19.0/"Hi-Skor" 800-X	Rem. SP20	1220	9,500
	1	Fed. 209	19.0/"Hi-Skor" 800-X	Win. WAA20F1	1220	10,000
	1	Fed. 209	16.0/Unique	Rem. SP20	1165	11,000*
Case	Shot Wgt. in Oz.	Primer	—Powder— Grains/Type	Wad	Velocity fps	Pressure LUP/psi*

20-Gauge — 2¾″ Shells

Case	Shot Wgt. in Oz.	Primer	—Powder— Grains/Type	Wad	Velocity fps	Pressure LUP/psi*
Federal Plastic Target (continued)	1	Fed. 209	17.0/Herco	Rem. SP20	1165	9,500*
	1	Fed. 209	16.5/Herco	Win. WAA20F1	1165	11,000*
	1	Fed. 209	17.0/Herco	Rem. RXP20	1165	11,500*
	1	Fed. 209	15.5/Unique	Win. WAA20F1	1165	11,500*
	1	Fed. 209	17.5/"Hi-Skor" 800-X	Fed. 20S1	1165	9,500
	1	Fed. 209	17.5/"Hi-Skor" 800-X	Rem. SP20	1165	9,000
	1	Fed. 209	17.5/"Hi-Skor" 800-X	Win. WAA20F1	1165	9,000
Remington Plastic Premier Target	1	Rem. 209P	24.0/Blue Dot	Rem. SP20	1220	11,000*
	1	Rem. 209P	23.5/Blue Dot	Win. WAA20F1	1220	11,000*
	1	Win. 209	22.0/Blue Dot	Rem. SP20	1220	11,000*
	1	Fio. 616	23.5/Blue Dot	Rem. SP20	1220	11,000*
	1	CCI 209M	22.5/Blue Dot	Rem. SP20	1220	11,000*
	1	CCI 209	23.0/Blue Dot	Rem. SP20	1220	10,500*
	1	Rem. 209P	21.5/Blue Dot	Rem. SP20	1165	9,000*
	1	Rem. 209P	17.5/Herco	Win. WAA20F1	1165	11,500*
	1	Rem. 209P	21.5/Blue Dot	Win. WAA20F1	1165	9,000*
	1	Fed. 209	20.5/Blue Dot	Rem. SP20	1165	11,500*
Case	Shot Wgt. in Oz.	Primer	—Powder— Grains/Type	Wad	Velocity fps	Pressure LUP/psi*

Case	Shot Wgt. in Oz.	Primer	—Powder— Grains/Type	Wad	Velocity fps	Pressure LUP/psi*
Remington Plastic Premier Target (continued)	1	Win. 209	21.5/Blue Dot	Rem. SP20	1165	10,500*
	1	Fio. 209	22.5/Blue Dot	Rem. SP20	1165	10,000*
	1	CCI 209M	21.5/Blue Dot	Rem. SP20	1165	10,500*
	1	CCI 209	22.0/Blue Dot	Rem. SP20	1165	9,500*
Winchester Plastic AA Compression Formed	1	Win. 209	23.0/Blue Dot	Rem. RXP20	1220	11,500*
	1	Win. 209	23.5/Blue Dot	Rem. SP20	1220	11,500*
	1	Win. 209	23.0/Blue Dot	Win. WAA20F1	1220	11,500*
	1	Win. 209	22.5/540	Win. WAA20F1	1220	11,000
	1	Win. 209	24.0/540	Rem. SP20	1220	10,700
	1	Win. 209	24.5/571	Rem. SP20	1220	10,500
	1	Win. 209	16.5/Herco	Rem. RXP20	1165	9,600*
	1	Win. 209	16.5/Herco	Rem. SP20	1165	10,000*
	1	Win. 209	16.5/Herco	Win. WAA20	1165	10,500*
	1	Win. 209	21.5/540	Win. WAA20F1	1165	10,000
	1	Win. 209	23.0/540	Rem. SP20	1165	10,000
	1	Win. 209	23.5/571	Win. WAA20F1	1165	9,500
	1	Win. 209	23.5/571	Rem. SP20	1165	10,000
	1	Win. 209	16.6/"Hi-Skor" 800-X	Win. WAA20F1	1165	10,000
	1	Win. 209	17.0/"Hi-Skor" 800-X	Rem. RXP20	1165	10,500
Case	Shot Wgt. in Oz.	Primer	—Powder— Grains/Type	Wad	Velocity fps	Pressure LUP/psi*

28-Gauge — $2\frac{3}{4}''$ Shells

Case	Shot Wgt. in Oz.	Primer	—Powder— Grains/Type	Wad	Velocity fps	Pressure LUP/psi*
Federal Plastic Target	3/4	Fed. 209	20.0/Blue Dot	Rem. SP28	1295	11,000*
	3/4	Fed. 209	16.0/"Hi-Skor" 800-X	Win. WAA28	1295	10,700
	3/4	CCI 209M	16.0/"Hi-Skor" 800-X	Rem. SP28	1295	10,500
	3/4	CCI 209M	16.0/"Hi-Skor" 800-X	Win. WAA28	1295	10,200
	3/4	CCI 209M	16.0/"Hi-Skor" 800-X	Fed. 28S1	1295	10,700
Remington Plastic Target	3/4	Rem. 209P	15.0/Unique	Rem. SP28	1295	10,500*
	3/4	Rem. 209P	16.5/Herco	Rem. SP28	1295	10,500*
	3/4	Rem. 209P	21.0/Blue Dot	Rem. SP28	1295	9,700*
	3/4	CCI 209M	15.5/"Hi-Skor" 800-X	Rem. SP28	1295	10,700
	3/4	CCI 209M	16.0/"Hi-Skor" 800-X	Win. WAA28	1295	11,000
Winchester Plastic AA Compression Formed	3/4	Win. 209	20.5/571	Win. WAA28	1260	11,000
	3/4	CCI 109	20.5/571	Win. WAA28	1260	11,000
	3/4	Rem. 209P	17.5/"Hi-Skor" 800-X	Win. WAA28	1295	10,000
	11/16	CCI 209	16.5/SR 4756	Fed. 28S1	1260	11,500
Case	Shot Wgt. in Oz.	Primer	—Powder— Grains/Type	Wad	Velocity fps	Pressure LUP/psi*

410-Bore — $2\frac{3}{4}$″ Shells

Case	Shot Wgt. in Oz.	Primer	—Powder— Grains/Type	Wad	Velocity fps	Pressure LUP/psi*
Remington Plastic	11/16	Rem. 209P	14.5/Hercules 2400	Rem. SP410	1351	13,000*
	11/16	Rem. 209P	14.5/Hercules 2400	Fed. 410SC	1135	12,500*
	11/16	Rem. 209P	14.5/Hercules 2400	Win. WAA41	1135	12,500*
	11/16	CCI 209M	14.5/Hercules 2400	Rem. SP410	1135	12,200*
	11/16	Rem. 209P	18.5/IMR 4227	Rem. SP410	1135	10,000
	11/16	Rem. 209P	18.5/IMR 4227	Fed. 410SC	1135	10,500
	11/16	Win. 209	17.5/IMR 4227	Rem. SP410	1135	11,500
Winchester Plastic AA Compression Formed	11/16	Win. 209	13.5/296	Win. WAA41	1135	11,000
	11/16	Win. 209	13.5/296	Fed. 410SC	1135	11,000
	5/8	Win. 209	17.5/IMR 4227	Fed. 410SC	1160	12,500
	5/8	Win. 209	17.4/IMR 4227	Rem. SP410	1160	12,500
Case	Shot Wgt. in Oz.	Primer	—Powder— Grains/Type	Wad	Velocity fps	Pressure LUP/psi*

Target Load Index

12-Gauge — $2\frac{3}{4}''$ Shells

Case	Shot Wgt. in Oz.	Primer	—Powder— Grains/Type	Wad	Velocity fps	Pressure LUP/psi*
Federal Paper Target	$1\frac{1}{8}$	Fed. 209	19.0/Red Dot	Fed. 12C1	1200	9,500*
	$1\frac{1}{8}$	Fed. 209	19.0/Red Dot	Fed. 12S3	1200	10,000*
	$1\frac{1}{8}$	Fed. 209	19.5/Red Dot	Rem. R12L	1200	9,500*
	$1\frac{1}{8}$	Fed. 209	19.0/Red Dot	Rem. R12H	1200	9,200*
	$1\frac{1}{8}$	Fed. 209	19.0/Red Dot	Rem. RXP12	1200	10,000*
	$1\frac{1}{8}$	Fed. 209	19.0/Red Dot	Win. WAA12	1200	10,500*
	$1\frac{1}{8}$	Rem. 209P	20.0/Red Dot	Fed. 12C1	1200	9,200*
	$1\frac{1}{8}$	Win. 209	19.5/Red Dot	Fed. 12C1	1200	10,000*
	$1\frac{1}{8}$	CCI 109	19.0/Red Dot	Fed. 12C1	1200	9,200*
	$1\frac{1}{8}$	CCI 209M	20.0/Red Dot	Fed. 12C1	1200	8,700*
	$1\frac{1}{8}$	Fed. 209	19.5/"Hi-Skor" 700-X	Fed. 12C1	1200	9,000
	$1\frac{1}{8}$	Fed. 209	20.5/"Hi-Skor" 700-X	Rem. R12L	1200	8,500
	$1\frac{1}{8}$	Fed. 209	19.0/"Hi-Skor" 700-X	Win. WAA12	1200	9,200
	$1\frac{1}{8}$	CCI 209	20.0/"Hi-Skor" 700-X	Fed. 12C1	1200	9,500
	$1\frac{1}{8}$	CCI 209	19.5/"Hi-Skor" 700-X	Win. WAA12	1200	8,500
Case	Shot Wgt. in Oz.	Primer	—Powder— Grains/Type	Wad	Velocity fps	Pressure LUP/psi*

12-Gauge – $2^3/_4$″ Shells

Case	Shot Wgt. in Oz.	Primer	—Powder— Grains/Type	Wad	Velocity fps	Pressure LUP/psi*
Federal Paper Target (continued)	1⅛	Rem. 209P	18.5/"Hi-Skor" 700-X	Fed. 12C1	1200	8,500
	1⅛	Rem. 209P	19.0/"Hi-Skor" 700-X	Activ L33	1200	9,000
	1⅛	Rem. 209P	18.5/"Hi-Skor" 700-X	Rem. R12L	1200	8,000
	1⅛	Rem. 209P	18.0/"Hi-Skor" 700-X	Win. WAA12	1200	9,500*
	1⅛	Win. 209	20.0/"Hi-Skor" 700-X	Fed. 12C1	1200	9,500
	1⅛	Win. 209	20.5/"Hi-Skor" 700-X	Rem. R12L	1200	8,500
	1⅛	Win. 209	20.0/"Hi-Skor" 700-X	Win. WAA12	1200	8,200
	1⅛	Fed. 209	18.0/Red Dot	Fed. 12C1	1145	8,500*
	1⅛	Fed. 209	18.0/Red Dot	Fed. 12S3	1145	8,700*
	1⅛	Fed. 209	18.5/Red Dot	Rem. R12L	1145	9,500*
	1⅛	Fed. 209	18.0/Red Dot	Rem. RXP12	1145	9,000*
	1⅛	Fed. 209	18.0/Red Dot	Win. WAA12	1145	8,500*
	1⅛	Rem. 209P	18.5/Red Dot	Fed. 12C1	1145	8,500*
Case	Shot Wgt. in Oz.	Primer	—Powder— Grains/Type	Wad	Velocity fps	Pressure LUP/psi*

Case	Shot Wgt. in Oz.	Primer	—Powder— Grains/Type	Wad	Velocity fps	Pressure LUP/psi*
Federal Paper Target (continued)	1⅛	Win. 209	18.5/Red Dot	Fed. 12C1	1145	8,500*
	1⅛	CCI 109	18.5/Red Dot	Fed. 12C1	1145	8,500*
	1⅛	CCI 209M	18.5/Red Dot	Fed. 12C1	1145	8,000*
	1⅛	Fed. 209	18.0/"Hi-Skor" 700-X	Fed. 12C1	1145	8,500
	1⅛	Fed. 209	18.0/"Hi-Skor" 700-X	Win. WAA12	1145	8,500
	1⅛	CCI 209	18.5/"Hi-Skor" 700-X	Fed. 12C1	1145	8,500
	1⅛	Rem. 209P	17.0/"Hi-Skor" 700-X	Fed. 12C1	1145	8,000
	1⅛	Rem. 209P	17.5/"Hi-Skor" 700-X	Activ L33	1145	8,500
	1	Fed. 209	19.0/Red Dot	Fed. 12S0	1200	8,000*
	1	Rem. 209P	17.0/"Hi-Skor" 700-X	Activ L29	1200	8,500
	1	Fed. 209	18.5/"Hi-Skor" 700-X	Fed. 12S0	1200	8,500
	1	Rem. 209P	17.5/"Hi-Skor" 700-X	Fed. 12S3	1200	8,000
Federal Plastic Gold Medal	1⅛	Fed. 209	18.5/Red Dot	Fed. 12S3	1200	10,000*
	1⅛	Fed. 209	19.0/Red Dot	Rem. RXP12	1200	10,500*
Case	Shot Wgt. in Oz.	Primer	—Powder— Grains/Type	Wad	Velocity fps	Pressure LUP/psi*

12-Gauge — $2^3/_4$″ Shells

Case	Shot Wgt. in Oz.	Primer	—Powder— Grains/Type	Wad	Velocity fps	Pressure LUP/psi*
Federal Plastic Gold Medal (continued)	1⅛	Fed. 209	19.0/Red Dot	Win. WAA12	1200	10,000*
	1⅛	Rem. 209P	19.5/Red Dot	Fed. 12S3	1200	9,500*
	1⅛	Win. 209	19.0/Red Dot	Fed. 12S3	1200	10,500*
	1⅛	CCI 209	20.0/Red Dot	Fed. 12S3	1200	10,000*
	1⅛	CCI 209M	19.0/Red Dot	Fed. 12S3	1200	9,000*
	1⅛	Fed. 209	19.5/"Hi-Skor" 700-X	Fed. 12S3	1200	9,000
	1⅛	Fed. 209	19.5/"Hi-Skor" 700-X	Rem. R12L	1200	8,500
	1⅛	CCI 209	20.0/"Hi-Skor" 700-X	Rem. R12L	1200	8,000
	1⅛	Rem. 209P	18.5/"Hi-Skor" 700-X	Fed. 12S3	1200	9,000
	1⅛	Rem. 209P	18.5/"Hi-Skor" 700-X	Activ L33	1200	9,500
	1⅛	Rem. 209P	18.5/"Hi-Skor" 700-X	Rem. R12L	1200	8,500
	1⅛	Win. 209	19.5/"Hi-Skor" 700-X	Fed. 12S3	1200	8,500
	1⅛	Win. 209	19.5/"Hi-Skor" 700-X	Rem. R12L	1200	8,500
Case	Shot Wgt. in Oz.	Primer	—Powder— Grains/Type	Wad	Velocity fps	Pressure LUP/psi*

Case	Shot Wgt. in Oz.	Primer	—Powder— Grains/Type	Wad	Velocity fps	Pressure LUP/psi*
Federal Plastic Gold Medal (continued)	1⅛	Win. 209	21.0/WST	Fed. 12S3	1200	9,500*
	1⅛	CCI 209	21.0/WST	Fed. 12S3	1200	10,500*
	1⅛	Fed. 209	21.5/WST	Fed. 12S3	1200	9,000*
	1⅛	Fed. 209	17.5/Red Dot	Fed. 12S3	1145	9,000*
	1⅛	Fed. 209	18.0/Red Dot	Rem. RXP12	1145	9,000*
	1⅛	Fed. 209	17.5/Red Dot	Win. WAA12	1145	9,000*
	1⅛	Rem. 209P	18.5/Red Dot	Fed. 12S3	1145	8,200*
	1⅛	Win. 209	17.5/Red Dot	Fed. 12S3	1145	9,500*
	1⅛	CCI 209	18.0/Red Dot	Fed. 12S3	1145	8,200*
	1⅛	CCI 209M	18.0/Red Dot	Fed. 12S3	1145	8,500*
	1⅛	Rem. 209P	17.0/"Hi-Skor" 700-X	Activ L33	1145	8,500
	1⅛	Rem. 209P	17.5/"Hi-Skor" 700-X	Rem. R12L	1145	8,000
	1⅛	Rem. 209P	16.5/"Hi-Skor" 700-X	Fed. 12S3	1145	8,000
	1⅛	CCI 209	19.5/WST	Fed. 12S3	1145	8,500*
	1⅛	Fed. 209	17.0/Red Dot	Fed. 12S3	1090	8,500*
	1⅛	Fed. 209	17.0/Red Dot	Win. WAA12	1090	8,200*
	1⅛	Win. 209	17.0/Red Dot	Fed. 12S3	1090	8,500*

| Case | Shot Wgt. in Oz. | Primer | —Powder— Grains/Type | Wad | Velocity fps | Pressure LUP/psi* |

12-Gauge — 2¾″ Shells

Case	Shot Wgt. in Oz.	Primer	—Powder— Grains/Type	Wad	Velocity fps	Pressure LUP/psi*
Federal Plastic Gold Medal (continued)	1⅛	CCI 209M	17.0/Red Dot	Fed. 12S3	1090	8,500*
	1⅛	Fio. 616	17.5/Red Dot	Fed. 12S3	1090	8,200*
	1	CCI 209	19.0/Red Dot	Fed. 12S0	1200	7,600*
	1	Fed. 209	18.0/"Hi-Skor" 700-X	Fed. 12S0	1180	8,000
Remington Plastic Premier Target	1⅛	Rem. 209P	19.0/Red Dot	Rem. Fig. 8	1200	10,000*
	1⅛	Rem. 209P	19.0/Red Dot	Rem. RXP12	1200	10,000*
	1⅛	Fed. 209	19.0/Red Dot	Rem. Fig. 8	1200	10,500*
	1⅛	Win. 209	19.0/Red Dot	Rem. Fig. 8	1200	10,500*
	1⅛	CCI 209M	18.5/Red Dot	Rem. Fig. 8	1200	10,500*
	1⅛	CCI 209	19.5/Red Dot	Rem. Fig. 8	1200	10,000*
	1⅛	Fio. 616	19.5/Red Dot	Rem. Fig. 8	1200	10,500*
	1⅛	Rem. 209P	19.0/"Hi-Skor" 700-X	Rem. Fig. 8	1200	10,500
	1⅛	Rem. 209P	19.0/"Hi-Skor" 700-X	Rem. RXP12	1200	10,500
	1⅛	Rem. 209P	19.0/"Hi-Skor" 700-X	Activ T32	1200	10,500
	1⅛	Rem. 209P	19.5/"Hi-Skor" 700-X	Fed. 12C1	1200	10,500
Case	Shot Wgt. in Oz.	Primer	—Powder— Grains/Type	Wad	Velocity fps	Pressure LUP/psi*

Case	Shot Wgt. in Oz.	Primer	—Powder— Grains/Type	Wad	Velocity fps	Pressure LUP/psi*
Remington Plastic Premier Target (continued)	1⅛	Rem. 209P	19.0/"Hi-Skor" 700-X	Win. WAA12	1200	10,500
	1⅛	Fed. 209	19.0/"Hi-Skor" 700-X	Rem. Fig. 8	1200	10,500
	1⅛	Fed. 209	19.5/"Hi-Skor" 700-X	Fed. 12C1	1200	10,500
	1⅛	Win. 209	19.0/"Hi-Skor" 700-X	Rem. Fig. 8	1200	10,500
	1⅛	Win. 209	19.0/"Hi-Skor" 700-X	Win. WAA12	1200	11,000
	1⅛	Win. 209	19.5/WSL	Win. WAA12SL	1200	9,500*
	1⅛	Win. 209	19.5/WSL	Win. WAA12	1200	9,700*
	1⅛	Win. 209	19.5/WSL	Rem. RXP12	1200	9,500*
	1⅛	Win. 209	19.5/WSL	Rem. Fig. 8	1200	9,500*
	1⅛	Win. 209	19.5/WSL	Fed. 12S3	1200	10,200*
	1⅛	CCI 209	19.0/WSL	Win. WAA12SL	1200	10,000*
	1⅛	CCI 209	19.0/WSL	Win. WAA12	1200	11,000*
	1⅛	CCI 209	19.0/WSL	Rem. RXP12	1200	10,000*
	1⅛	CCI 209	19.0/WSL	Rem. Fig. 8	1200	9,500*
	1⅛	Fed. 209	20.0/WSL	Win. WAA12SL	1200	9,000*
	1⅛	Fed. 209	19.0/WSL	Win. WAA12	1200	8,700*
Case	Shot Wgt. in Oz.	Primer	—Powder— Grains/Type	Wad	Velocity fps	Pressure LUP/psi*

12-Gauge – 2¾″ Shells

Case	Shot Wgt. in Oz.	Primer	—Powder— Grains/Type	Wad	Velocity fps	Pressure LUP/psi*
Remington Plastic Premier Target (continued)	1⅛	Fed. 209	19.5/WSL	Rem. RXP12	1200	9,000*
	1⅛	Fed. 209	20.0/WSL	Rem. Fig. 8	1200	8,000*
	1⅛	Fed. 209	19.0/WSL	Fed. 12S3	1200	9,200
	1⅛	Rem. 209P	18.0/Red Dot	Rem. Fig. 8	1145	9,200*
	1⅛	Rem. 209P	18.0/Red Dot	Fed. 12S3	1145	10,000*
	1⅛	Rem. 209P	17.5/Red Dot	Rem. RXP12	1145	9,000*
	1⅛	Rem. 209P	17.0/Red Dot	Win. WAA12	1145	10,000*
	1⅛	Fed. 209	17.5/Red Dot	Rem. Fig. 8	1145	9,000*
	1⅛	Win. 209	18.0/Red Dot	Rem. Fig. 8	1145	9,500*
	1⅛	CCI 209M	17.5/Red Dot	Rem. Fig. 8	1145	9,500*
	1⅛	CCI 209	17.5/Red Dot	Rem. Fig. 8	1145	8,500*
	1⅛	Fio. 616	17.5/Red Dot	Rem. Fig. 8	1145	9,000*
	1⅛	Rem. 209P	17.5/"Hi-Skor" 700-X	Rem. Fig. 8	1145	9,500
	1⅛	Rem. 209P	17.5/"Hi-Skor" 700-X	Rem. RXP12	1145	9,500
	1⅛	Rem. 209P	17.5/"Hi-Skor" 700-X	Activ T32	1145	9,500
	1⅛	Rem. 209P	18.5/"Hi-Skor" 700-X	Fed. 12C1	1145	9,000*
Case	Shot Wgt. in Oz.	Primer	—Powder— Grains/Type	Wad	Velocity fps	Pressure LUP/psi*

Case	Shot Wgt. in Oz.	Primer	—Powder— Grains/Type	Wad	Velocity fps	Pressure LUP/psi*
Remington Plastic Premier Target (continued)	1⅛	Rem. 209P	17.5/"Hi-Skor" 700-X	Win. WAA12	1145	10,000*
	1⅛	Fed. 209	17.5/"Hi-Skor" 700-X	Rem. Fig. 8	1145	9,500
	1⅛	Fed. 209	18.0/"Hi-Skor" 700-X	Fed. 12C1	1145	9,500*
	1⅛	Win. 209	17.5/"Hi-Skor" 700-X	Rem. Fig. 8	1145	9,500*
	1⅛	Win. 209	17.5/"Hi-Skor" 700-X	Win. WAA12	1145	10,000*
	1⅛	Win. 209	18.5/WSL	Win. WAA12	1145	8,500*
	1⅛	CCI 209	18.0/WSL	Win. WAA12	1145	9,000*
	1⅛	CCI 209	18.0/WSL	Fed. 12S3	1145	8,500*
	1⅛	Fed. 209	18.5/WSL	Win. WAA12SL	1145	8,000*
	1⅛	Fed. 209	18.0/WSL	Win. WAA12	1145	8,500*
	1⅛	Fed. 209	18.5/WSL	Fed. 12S3	1145	8,500*
	1⅛	Win. 209	19.0/WST	Rem. RXP12	1145	10,500*
	1⅛	Win. 209	19.0/WST	Rem. Fig. 8	1145	10,500*
	1⅛	CCI 209	18.0/WST	Win. WAA12	1145	11,000*
	1⅛	CCI 209	18.5/WST	Rem. RXP12	1145	11,000*
	1⅛	CCI 209	18.5/WST	Rem. Fig. 8	1145	10,200*
Case	Shot Wgt. in Oz.	Primer	—Powder— Grains/Type	Wad	Velocity fps	Pressure LUP/psi*

12-Gauge — $2^3/_4''$ Shells

Case	Shot Wgt. in Oz.	Primer	—Powder— Grains/Type	Wad	Velocity fps	Pressure LUP/psi*
Remington Plastic Premier Target (continued)	$1^1/_8$	Fed. 209	18.5/WST	Rem. RXP12	1145	10,000*
	$1^1/_8$	Fed. 209	18.5/WST	Rem. Fig. 8	1145	10,000*
	$1^1/_8$	Rem. 209P	16.5/Red Dot	Rem. Fig. 8	1090	8,700*
	$1^1/_8$	Rem. 209P	16.0/Red Dot	Rem. RXP12	1090	8,500*
	$1^1/_8$	Rem. 209P	16.0/Red Dot	Fed. 12S3	1090	10,500*
	$1^1/_8$	Rem. 209P	16.0/Red Dot	Win. WAA12	1090	9,500*
	$1^1/_8$	Fed. 209	16.0/Red Dot	Rem. Fig. 8	1090	10,000*
	$1^1/_8$	Win. 209	16.5/Red Dot	Rem. Fig. 8	1090	9,000*
	$1^1/_8$	CCI 209M	16.5/Red Dot	Rem. Fig. 8	1090	9,000*
	$1^1/_8$	Fio. 616	16.5/Red Dot	Rem. Fig. 8	1090	9,000*
	1	Rem. 209P	18.0/Red Dot	Rem. Fig. 8	1200	8,500*
	1	Rem. 209P	18.0/Red Dot	Fed. 12S0	1200	9,000*
	1	CCI 209M	17.5/Red Dot	Rem. Fig. 8	1200	9,000*
	1	Fed. 209	18.0/Red Dot	Rem. Fig. 8	1200	8,500*
	1	Win. 209	19.0/WST	Fed. 12S0	1180	8,200*
	1	CCI 209	19.0/WST	Win. WAA12SL	1180	8,000*
	1	CCI 209	18.5/WST	Fed. 12S0	1180	9,000*
	1	Fed. 209	19.0/WST	Win. WAA12SL	1180	8,000*
	1	Fed. 209	19.0/WST	Fed. 12S0	1180	8,500*
Case	Shot Wgt. in Oz.	Primer	—Powder— Grains/Type	Wad	Velocity fps	Pressure LUP/psi*

Case	Shot Wgt. in Oz.	Primer	—Powder— Grains/Type	Wad	Velocity fps	Pressure LUP/psi*
Winchester Plastic AA Compression Formed	1⅛	Win. 209	18.5/Red Dot	Fed. 12C1	1200	9,700*
	1⅛	Win. 209	19.0/Red Dot	Fed. 12C2	1200	8,500*
	1⅛	Win. 209	18.5/Red Dot	Rem. R12H	1200	9,500*
	1⅛	Win. 209	18.5/Red Dot	Rem. RXP12	1200	10,000*
	1⅛	Win. 209	18.0/Red Dot	Win. WAA12	1200	10,500*
	1⅛	Fed. 209	17.5/Red Dot	Win. WAA12	1200	10,500*
	1⅛	Rem. 209P	19.0/Red Dot	Win. WAA12	1200	9,500*
	1⅛	CCI 109	18.0/Red Dot	Win. WAA12	1200	10,500*
	1⅛	CCI 209M	18.5/Red Dot	Win. WAA12	1200	10,500*
	1⅛	Fio. 616	18.0/Red Dot	Win. WAA12	1200	10,500*
	1⅛	Win. 209	19.0/"Hi-Skor" 700-X	Win. WAA12	1200	9,200
	1⅛	Win. 209	19.0/"Hi-Skor" 700-X	Fed. 12S1	1200	8,500
	1⅛	Win. 209	19.0/"Hi-Skor" 700-X	Rem. RXP12	1200	9,000
	1⅛	Fed. 209	19.0/"Hi-Skor" 700-X	Win. WAA12	1200	10,000
	1⅛	Fed. 209	18.5/"Hi-Skor" 700-X	Fed. 12S1	1200	10,000
Case	Shot Wgt. in Oz.	Primer	—Powder— Grains/Type	Wad	Velocity fps	Pressure LUP/psi*

12-Gauge — 2¾″ Shells

Case	Shot Wgt. in Oz.	Primer	—Powder— Grains/Type	Wad	Velocity fps	Pressure LUP/psi*
Winchester Plastic AA Compression Formed (continued)	1⅛	Fed. 209	19.0/"Hi-Skor" 700-X	Rem. RXP12	1200	9,500
	1⅛	CCI 209	19.0/"Hi-Skor" 700-X	Win. WAA12	1200	10,200
	1⅛	CCI 209	19.0/"Hi-Skor" 700-X	Fed. 12S1	1200	9,000
	1⅛	CCI 209	19.0/"Hi-Skor" 700-X	Rem. RXP12	1200	9,000*
	1⅛	Rem. 209P	17.5/"Hi-Skor" 700-X	Win. WAA12	1200	9,000
	1⅛	Rem. 209P	18.5/"Hi-Skor" 700-X	Activ T35	1200	9,500
	1⅛	Rem. 209P	18.0/"Hi-Skor" 700-X	Fed. 12S1	1200	9,200
	1⅛	Rem. 209P	18.0/"Hi-Skor" 700-X	Rem. RXP12	1200	9,700
	1⅛	Rem. 209P	18.5/"Hi-Skor" 700-X	Rem. Fig. 8	1200	10,500
	1⅛	Win. 209	20.0/WST	Win. WAA12	1200	10,000*
	1⅛	Win. 209	20.0/WST	Rem. RXP12	1200	9,700*
	1⅛	Win. 209	20.5/WST	Rem. Fig. 8	1200	10,000*
Case	Shot Wgt. in Oz.	Primer	—Powder— Grains/Type	Wad	Velocity fps	Pressure LUP/psi*

Target

Case	Shot Wgt. in Oz.	Primer	—Powder— Grains/Type	Wad	Velocity fps	Pressure LUP/psi*
Winchester Plastic AA Compression Formed (continued)	1⅛	Win. 209	20.0/WST	Fed. 12S3	1200	11,000*
	1⅛	CCI 209	20.5/WST	Win. WAA12	1200	10,500*
	1⅛	CCI 209	20.5/WST	Rem. RXP12	1200	10,500*
	1⅛	CCI 209	20.5/WST	Rem. Fig. 8	1200	10,000*
	1⅛	CCI 209	20.5/WST	Fed. 12S3	1200	11,000*
	1⅛	Fed. 209	20.5/WST	Win. WAA12	1200	10,000*
	1⅛	Fed. 209	21.0/WST	Rem. RXP12	1200	10,000*
	1⅛	Fed. 209	21.0/WST	Rem. Fig. 8	1200	9,200*
	1⅛	Fed. 209	21.0/WST	Fed. 12S3	1200	11,000*
	1⅛	Win. 209	20.0/WSL	Win. WAA12SL	1200	9,000*
	1⅛	Win. 209	20.0/WSL	Win. WAA12	1200	10,000*
	1⅛	Win. 209	19.5/WSL	Rem. RXP12	1200	10,000*
	1⅛	Win. 209	20.0/WSL	Rem. Fig. 8	1200	9,500*
	1⅛	Win. 209	20.0/WSL	Fed. 12S3	1200	10,200*
	1⅛	CCI 209	19.5/WSL	Win. WAA12SL	1200	10,000*
	1⅛	CCI 209	19.5/WSL	Win. WAA12	1200	11,000*
	1⅛	CCI 209	19.5/WSL	Rem. Fig. 8	1200	9,700*
	1⅛	CCI 209	19.5/WSL	Rem. R12L	1200	9,200*
	1⅛	CCI 209	19.5/WSL	Fed. 12S3	1200	10,700*
	1⅛	Fed. 209	20.0/WSL	Win. WAA12SL	1200	9,000*

Case | Shot Wgt. in Oz. | Primer | —Powder— Grains/Type | Wad | Velocity fps | Pressure LUP/psi*

12-Gauge — 2¾″ Shells

Case	Shot Wgt. in Oz.	Primer	—Powder— Grains/Type	Wad	Velocity fps	Pressure LUP/psi*
Winchester Plastic AA Compression Formed (continued)	1⅛	Fed. 209	20.0/WSL	Win. WAA12	1200	10,500*
	1⅛	Fed. 209	20.0/WSL	Rem. RXP12	1200	9,500*
	1⅛	Fed. 209	20.0/WSL	Rem. Fig. 8	1200	9,500*
	1⅛	Fed. 209	20.0/WSL	Fed. 12S3	1200	10,500*
	1⅛	Win. 209	17.5/Red Dot	Fed. 12C1	1145	9,500*
	1⅛	Win. 209	17.5/Red Dot	Fed. 12C2	1145	8,000*
	1⅛	Win. 209	17.0/Red Dot	Rem. R12H	1145	8,500*
	1⅛	Win. 209	17.0/Red Dot	Rem. RXP12	1145	8,500*
	1⅛	Win. 209	17.0/Red Dot	Win. WAA12	1145	10,000*
	1⅛	Win. 209	16.5/Red Dot	Activ T32	1145	9,500*
	1⅛	Fed. 209	17.0/Red Dot	Win. WAA12	1200	10,000*
	1⅛	Rem. 209P	17.5/Red Dot	Win. WAA12	1200	8,700*
	1⅛	CCI 109	17.0/Red Dot	Win. WAA12	1200	9,200*
	1⅛	CCI 209M	17.5/Red Dot	Win. WAA12	1200	10,500*
	1⅛	Fio. 616	17.0/Red Dot	Win. WAA12	1200	10,200*
	1⅛	Win. 209	17.5/"Hi-Skor" 700-X	Win. WAA12	1145	8,000
	1⅛	Win. 209	18.0/"Hi-Skor" 700-X	Fed. 12S1	1145	8,000

Case | Shot Wgt. in Oz. | Primer | —Powder— Grains/Type | Wad | Velocity fps | Pressure LUP/psi*

Case	Shot Wgt. in Oz.	Primer	—Powder— Grains/Type	Wad	Velocity fps	Pressure LUP/psi*
Winchester Plastic AA Compression Formed (continued)	1⅛	Win. 209	18.0/"Hi-Skor" 700-X	Rem. RXP12	1145	8,500
	1⅛	Fed. 209	17.5/"Hi-Skor" 700-X	Win. WAA12	1145	9,500
	1⅛	Fed. 209	17.0/"Hi-Skor" 700-X	Fed. 12S1	1145	8,500
	1⅛	Fed. 209	18.0/"Hi-Skor" 700-X	Rem. RXP12	1145	8,500
	1⅛	CCI 209	17.5/"Hi-Skor" 700-X	Win. WAA12	1145	8,500
	1⅛	CCI 209	17.5/"Hi-Skor" 700-X	Fed. 12S1	1145	8,500
	1⅛	CCI 209	17.5/"Hi-Skor" 700-X	Rem. RXP12	1145	8,500
	1⅛	Rem. 209P	16.0/"Hi-Skor" 700-X	Win. WAA12	1145	8,500
	1⅛	Rem. 209P	17.0/"Hi-Skor" 700-X	Activ T35	1145	8,700
	1⅛	Rem. 209P	17.0/"Hi-Skor" 700-X	Fed. 12S1	1145	8,700
	1⅛	Rem. 209P	17.0/"Hi-Skor" 700-X	Rem. Fig. 8	1145	9,500
	1⅛	Win. 209	18.5/WSL	Win. WAA12SL	1145	8,000*
Case	Shot Wgt. in Oz.	Primer	—Powder— Grains/Type	Wad	Velocity fps	Pressure LUP/psi*

12-Gauge — $2^3/_4$″ Shells

Case	Shot Wgt. in Oz.	Primer	—Powder— Grains/Type	Wad	Velocity fps	Pressure LUP/psi*
Winchester Plastic AA Compression Formed (continued)	1⅛	Win. 209	19.0/WSL	Rem. Fig. 8	1145	8,500*
	1⅛	CCI 209	18.5/WSL	Win. WAA12SL	1145	9,000*
	1⅛	CCI 209	18.5/WSL	Rem. Fig. 8	1145	8,500*
	1⅛	Fed. 209	19.0/WSL	Rem. RXP12	1145	8,200*
	1⅛	Fed. 209	19.0/WSL	Rem. Fig. 8	1145	8,000*
	1⅛	Fed. 209	19.0/WSL	Fed. 12S1	1145	8,000*
	1⅛	Win. 209	18.5/WST	Win. WAA12	1145	8,500*
	1⅛	Win. 209	19.0/WST	Rem. RXP12	1145	8,700*
	1⅛	Win. 209	19.0/WST	Rem. Fig. 8	1145	8,500*
	1⅛	Win. 209	19.0/WST	Fed. 12S3	1145	10,000*
	1⅛	CCI 209	19.0/WST	Win. WAA12	1145	9,000*
	1⅛	CCI 209	19.5/WST	Rem. RXP12	1145	9,000*
	1⅛	CCI 209	19.0/WST	Rem. Fig 8	1145	9,000
	1⅛	CCI 209	19.0/WST	Fed. 12S3	1145	9,500*
	1⅛	Fed. 209	19.0/WST	Win. WAA12	1145	9,000*
	1⅛	Fed. 209	19.5/WST	Rem. Fig. 8	1145	8,000*
	1⅛	Fed. 209	19.5/WST	Fed. 12S3	1145	10,000*
	1⅛	Win. 209	16.0/Red Dot	Win. WAA12	1090	9,500*
Case	Shot Wgt. in Oz.	Primer	—Powder— Grains/Type	Wad	Velocity fps	Pressure LUP/psi*

Case	Shot Wgt. in Oz.	Primer	—Powder— Grains/Type	Wad	Velocity fps	Pressure LUP/psi*
Winchester Plastic AA Compression Formed (continued)	1⅛	Win. 209	17.0/Red Dot	Fed. 12S3	1090	10,500*
	1⅛	Win. 209	16.5/Red Dot	Rem. RXP12	1090	9,000*
	1⅛	Win. 209	16.0/Red Dot	Activ T32	1090	8,500*
	1⅛	Fed. 209	16.0/Red Dot	Win. WAA12	1090	10,000*
	1⅛	Rem. 209P	17.0/Red Dot	Win. WAA12	1090	8,000*
	1⅛	CCI 209M	17.0/Red Dot	Win. WAA12	1090	10,000*
	1⅛	Fio. 616	16.0/Red Dot	Win. WAA12	1090	9,000*
	1	Win. 209	18.0/Red Dot	Fed. 12S0	1200	9,500*
	1	Win. 209	18.0/Red Dot	Fed. 12S1	1200	8,500*
	1	Win. 209	18.0/Red Dot	Rem. RXP12	1200	8,500*
	1	Win. 209	18.0/Red Dot	Win. WAA12	1200	9,000*
	1	Win. 209	18.0/Red Dot	Win. WAA12F1	1200	9,000*
	1	CCI 209M	17.5/Red Dot	Win. WAA12	1200	10,000*
	1	Win. 209	17.5/"Hi-Skor" 700-X	Win. WAA12F1	1200	8,500
	1	Win. 209	17.0/"Hi-Skor" 700-X	Fed. 12S0	1200	9,700
	1	Fed. 209	17.0/"Hi-Skor" 700-X	Win. WAA12F1	1200	9,000
	1	Fed. 209	17.5/"Hi-Skor" 700-X	Fed. 12S0	1200	10,000
Case	Shot Wgt. in Oz.	Primer	—Powder— Grains/Type	Wad	Velocity fps	Pressure LUP/psi*

12-Gauge – $2^3/_4$" Shells

Case	Shot Wgt. in Oz.	Primer	—Powder— Grains/Type	Wad	Velocity fps	Pressure LUP/psi*
Winchester Plastic AA Compression Formed (continued)	1	Win. 209	19.0/WST	Fed. 12S0	1180	8,000*
	1	CCI 209	19.0/WST	Fed. 12S0	1180	8,500*
	1	Win. 209	16.5/"Hi-Skor" 700-X	Fed. 12S0	1145	9,000
	1	Fed. 209	16.0/"Hi-Skor" 700-X	Win. WAA12F1	1145	8,500
	1	Fed. 209	16.5/"Hi-Skor" 700-X	Fed. 12S0	1145	9,500
	7/8**	Win. 209	16.0/Red Dot	Fed. 12S0	1200	8,000*
Activ Plastic	1⅛	CCI 209	20.0/Red Dot	Fed. 12S0	1200	8,200*
	1⅛	CCI 209M	19.5/Red Dot	Fed. 12S0	1200	10,000*
	1⅛	Fed. 209	19.5/Red Dot	Fed. 12S0	1200	9,500*
	1⅛	Win. 209	19.5/Red Dot	Fed. 12S0	1200	10,000*
	1⅛	Win. 209	19.5/Red Dot	Fed. 12S3	1200	10,500*
	1⅛	Win. 209	19.5/Red Dot	Win. WAA12F1	1200	8,700*
	1⅛	Fed. 209	19.5/"Hi-Skor" 700-X	Activ L33	1200	9,000
	1⅛	Rem. 209P	19.0/"Hi-Skor" 700-X	Activ L33	1200	10,000
Case	Shot Wgt. in Oz.	Primer	—Powder— Grains/Type	Wad	Velocity fps	Pressure LUP/psi*

Case	Shot Wgt. in Oz.	Primer	—Powder— Grains/Type	Wad	Velocity fps	Pressure LUP/psi*
Activ Plastic (continued)	1⅛	Win. 209	19.5/"Hi-Skor" 700-X	Activ L33	1200	8,000
	1⅛	CCI 209M	17.5/Red Dot	Fed. 12S0	1145	8,000*
	1⅛	Fed. 209	18.0/Red Dot	Fed. 12S0	1145	8,700*
	1⅛	Win. 209	18.5/Red Dot	Fed. 12S0	1145	9,000*
	1⅛	Win. 209	18.0/Red Dot	Fed. 12S3	1145	8,500*
	1⅛	Rem. 209P	17.5/"Hi-Skor" 700-X	Activ L33	1145	8,500
	1	Rem. 209P	18.0/"Hi-Skor" 700-X	Activ L29	1200	8,000
Fiocchi Plastic	1⅛	Fio. 616	20.0/Red Dot	Fed. 12S3	1200	9,000*
	1⅛	CCI 209M	18.5/Red Dot	Rem. RXP12	1200	9,500*
	1⅛	Rem. 209P	19.0/"Hi-Skor" 700-X	Rem. RXP12	1200	9,500
	1⅛	Rem. 209P	19.5/"Hi-Skor" 700-X	Win. WAA12	1200	10,000
	1⅛	Fed. 209	18.0/Red Dot	Fed. 12S3	1145	9,000*
	1⅛	Rem. 209P	17.5/"Hi-Skor" 700-X	Rem. RXP12	1200	9,000
	1⅛	Rem. 209P	17.5/"Hi-Skor" 700-X	Win. WAA12	1200	9,700
Case	Shot Wgt. in Oz.	Primer	—Powder— Grains/Type	Wad	Velocity fps	Pressure LUP/psi*

** This load may not function some semiautomatic shotguns.

16-Gauge — $2\frac{3}{4}$″ Shells

Case	Shot Wgt. in Oz.	Primer	—Powder— Grains/Type	Wad	Velocity fps	Pressure LUP/psi*
Remington Plastic SP Plastic Base Wad	1⅛	Rem. 209P	20.0/Unique	Win. WAA16	1185	10,500*
	1⅛	Rem. 209P	20.5/Unique	Activ G28	1185	10,700*
	1	Rem. 209P	16.5/Green Dot	Win. WAA16	1165	10,000*
	1	Rem. 209P	17.5/Green Dot	Activ G28	1185	9,700*
	1	Rem. 209P	19.0/Unique	Win. WAA16	1165	8,500*
	1	Rem. 209P	19.5/Unique	Activ G28	1165	8,500*
Winchester Plastic AA Compression Formed	1⅛	CCI 209	20.5/WSF	Win. WAA16	1185	11,000*
	1⅛	Win. 209	24.5/540	Win. WAA16	1185	11,000*
	1⅛	Fed. 209	24.0/540	Win. WAA16	1185	10,500*
	1⅛	CCI 209	24.5/540	Win. WAA16	1185	10,500*
	1⅛	Win. 209	26.5/540	Rem. SP16	1185	9,000
	1⅛	CCI 109	26.5/540	Rem. SP16	1185	8,500
	1⅛	Win. 209	26.0/571	Win. WAA16	1185	10,200*
	1⅛	Fed. 209	25.5/571	Win. WAA16	1185	10,200*
	1⅛	CCI 209	26.0/571	Win. WAA16	1185	10,000*
	1	Win. 209	20.0/WSF	Win. WAA16	1165	8,500*
	1	Win. 209	23.0/540	Win. WAA16	1165	8,700*
	1	Fed. 209	22.5/540	Win. WAA16	1165	8,700*
	1	CCI 209	23.5/540	Win. WAA16	1165	8,500*
Case	Shot Wgt. in Oz.	Primer	—Powder— Grains/Type	Wad	Velocity fps	Pressure LUP/psi*

Case	Shot Wgt. in Oz.	Primer	—Powder— Grains/Type	Wad	Velocity fps	Pressure LUP/psi*
Winchester Plastic AA Compression Formed (continued)	1	Win. 209	19.0/Unique	Win. WAA16	1165	9,200*
	1	Win. 209	17.5/Green Dot	Activ G28	1165	10,500*
	1	Win. 209	25.0/571	Win. WAA16	1165	8,500*
	1	Fed. 209	25.0/571	Win. WAA16	1165	8,500*
	1	CCI 209	25.0/571	Win. WAA16	1165	8,500*
Case	Shot Wgt. in Oz.	Primer	—Powder— Grains/Type	Wad	Velocity fps	Pressure LUP/psi*

1⅛-ounce loads for Skeet, trap and Sporting Clays. 1-ounce loads for Skeet and Sporting Clays.

20-Gauge – $2^3/_4$″ Shells

Case	Shot Wgt. in Oz.	Primer	—Powder— Grains/Type	Wad	Velocity fps	Pressure LUP/psi*
Federal Paper Target	7/8	Fed. 209	17.0/"Hi-Skor" 800-X	Fed. 20S1	1200	9,500
	7/8	Fed. 209	17.5/"Hi-Skor" 800-X	Win. WAA20	1200	8,500
	7/8	CCI 209M	17.0/"Hi-Skor" 800-X	Fed. 20S1	1200	8,500
	7/8	CCI 209M	17.5/"Hi-Skor" 800-X	Rem. RXP20	1200	8,000
	7/8	CCI 209M	17.5/"Hi-Skor" 800-X	Win. WAA20	1200	8,500
	7/8	Fed. 209	15.0/Green Dot	Fed. 20S1	1200	9,500*
	7/8	Fed. 209	15.5/Green Dot	Rem. RXP20	1200	11,000*
	7/8	Fed. 209	15.0/Green Dot	Win. WAA20	1200	9,700*
	7/8	CCI 109	15.0/Green Dot	Fed. 20S1	1200	9,000*
	7/8	CCI 109	16.0/Green Dot	Rem. RXP20	1200	10,000*
	7/8	CCI 109	15.5/Green Dot	Win. WAA20	1200	9,000*
	7/8	Fed. 209	17.0/"Hi-Skor" 800-X	Fed. 20S1	1200	9,500
	7/8	Fed. 209	17.0/"Hi-Skor" 800-X	Rem. RXP20	1200	8,000

| Case | Shot Wgt. in Oz. | Primer | —Powder— Grains/Type | Wad | Velocity fps | Pressure LUP/psi* |

Case	Shot Wgt. in Oz.	Primer	—Powder— Grains/Type	Wad	Velocity fps	Pressure LUP/psi*
Federal Paper Target (continued)	7/8	Fed. 209	17.5/"Hi-Skor" 800-X,	Win. WAA20	1200	8,500
	7/8	CCI 209M	17.0/"Hi-Skor" 800-X	Fed. 20S1	1200	9,500
	7/8	CCI 209M	17.5/"Hi-Skor" 800-X	Win. WAA20	1200	8,500
	7/8	CCI 109	14.0/Red Dot	Rem. RXP20	1155	11,500*
	7/8	CCI 109	15.0/Green Dot	Rem. RXP20	1155	8,700*
	7/8	CCI 109	14.5/Green Dot	Win. WAA20	1155	8,400*
	7/8	CCI 209M	14.5/Green Dot	Fed. 20S1	1155	10,000*
	3/4	Fed. 209	14.0/Green Dot	Fed. 12S1	1200	9,700*
	3/4	CCI 109	17.0/Green Dot	Rem. RXP20	1200	9,000*
Remington Plastic Premier Target	7/8	Fed. 209	16.5/Unique	Rem. RXP20	1200	11,500*
	7/8	Win. 209	16.5/Unique	Rem. RXP20	1200	11,500*
	7/8	Fio. 616	16.5/Unique	Rem. RXP20	1200	11,200*
	7/8	CCI 209M	16.0/Unique	Rem. RXP20	1200	11,500*
	7/8	CCI 209	16.5/Unique	Rem. RXP20	1200	10,000*
	7/8	Rem. 209P	14.5/Green Dot	Rem. RXP20	1155	11,500*
	7/8	Rem. 209P	15.5/Unique	Fed. 20S1	1155	10,000*
	7/8	Rem. 209P	14.0/Green Dot	Win. WAA20	1155	11,000*

Case	Shot Wgt. in Oz.	Primer	—Powder— Grains/Type	Wad	Velocity fps	Pressure LUP/psi*

20-Gauge – $2\frac{3}{4}''$ Shells

Case	Shot Wgt. in Oz.	Primer	—Powder— Grains/Type	Wad	Velocity fps	Pressure LUP/psi*
Remington Plastic Premier Target (continued)	7/8	Fed. 209	15.5/Unique	Rem. RXP20	1155	10,700*
	7/8	Win. 209	15.5/Unique	Rem. RXP20	1155	10,500*
	7/8	Fio. 616	16.0/Unique	Rem. RXP20	1155	10,700*
	7/8	CCI 209M	15.5/Unique	Rem. RXP20	1155	11,000*
	7/8	CCI 209	14.5/Green Dot	Rem. RXP20	1155	11,000*
Winchester Plastic AA Compression Formed	7/8	Win. 209	14.5/Green Dot	Fed. 20S1	1200	10,500*
	7/8	Win. 209	15.0/Green Dot	Rem. RXP20	1200	10,000*
	7/8	Win. 209	14.5/Green Dot	Win. WAA20	1200	10,500*
	7/8	CCI 109	14.5/Green Dot	Fed. 20S1	1200	10,500*
	7/8	CCI 109	15.0/Green Dot	Rem. RXP20	1200	10,000*
	7/8	CCI 109	14.5/Green Dot	Win. WAA20	1200	10,500*
	7/8	Win. 209	17.0/"Hi-Skor" 800-X	Win. WAA20	1200	10,000
	7/8	Win. 209	17.0/"Hi-Skor" 800-X	Rem. RXP20	1200	9,500
	7/8	Win. 209	17.0/"Hi-Skor" 800-X	Fed. 20S1	1200	10,500
	7/8	Fed. 209	16.5/"Hi-Skor" 800-X	Win. WAA20	1200	10,000
Case	Shot Wgt. in Oz.	Primer	—Powder— Grains/Type	Wad	Velocity fps	Pressure LUP/psi*

Case	Shot Wgt. in Oz.	Primer	—Powder— Grains/Type	Wad	Velocity fps	Pressure LUP/psi*
Winchester Plastic AA Compression Formed (continued)	7/8	Fed. 209	16.5/"Hi-Skor" 800-X	Rem. RXP20	1200	9,500
	7/8	Fed. 209	16.5/"Hi-Skor" 800-X	Fed. 20S1	1200	11,000
	7/8	Win. 209	16.5/WSF	Win. WAA20	1200	11,200*
	7/8	Win. 209	17.0/WSF	Rem. RXP20	1200	10,700*
	7/8	Fed. 209	16.5/WSF	Win. WAA20	1200	11,500*
	7/8	Fed. 209	17.0/WSF	Rem. RXP20	1200	10,500*
	7/8	CCI 209	16.5/WSF	Win. WAA20	1200	11,500*
	7/8	CCI 209	17.5/WSF	Rem. RXP20	1200	10,500*
	7/8	CCI 209	16.5/WSF	Fed. 20S1	1200	11,500*
	7/8	Fed. 209	16.5/WSF	Fed. 20S1	1200	11,400*
	7/8	Win. 209	14.0/Green Dot	Fed. 20S1	1155	10,300*
	7/8	Win. 209	14.5/Green Dot	Rem. RXP20	1155	10,000*
	7/8	Win. 209	14.0/Green Dot	Win. WAA20	1155	10,500*
	7/8	CCI 109	14.0/Green Dot	Fed. 20S1	1155	9,500*
	7/8	CCI 109	14.5/Green Dot	Rem. RXP20	1155	9,500*
	7/8	CCI 109	14.0/Green Dot	Win. WAA20	1155	10,000*
	7/8	CCI 209M	15.0/Unique	Win. WAA20	1155	10,200*
Activ Plastic	7/8	CCI 209M	18.0/Herco	Fed. 20S1	1200	9,500*
Case	Shot Wgt. in Oz.	Primer	—Powder— Grains/Type	Wad	Velocity fps	Pressure LUP/psi*

20-Gauge — 2¾″ Shells

Case	Shot Wgt. in Oz.	Primer	—Powder— Grains/Type	Wad	Velocity fps	Pressure LUP/psi*
Activ Plastic (continued)	⅞	CCI 209M	18.0/Herco	Win. WAA20	1200	9,500*
	⅞	CCI 209M	18.5/Herco	Rem. RXP20	1200	9,500*
	⅞	Fed. 209	17.0/"Hi-Skor" 800-X	Fed. 20S1	1200	8,000
	⅞	Rem. 209P	17.5/"Hi-Skor" 800-X	Rem. RXP20	1200	8,000
	⅞	Win. 209	17.0/"Hi-Skor" 800-X	Win. WAA20	1200	8,000
Fiocchi Plastic	⅞	Fio. 616	15.5/Green Dot	Fed. 20S1	1200	10,500*
	⅞	Fed. 209	15.5/Green Dot	Fed. 20S1	1200	11,000*
	⅞	Win. 209	16.0/Green Dot	Fed. 20S1	1200	10,500*
	⅞	CCI 209M	15.5/Green Dot	Fed. 20S1	1200	10,700*
	⅞	Fed. 209	14.5/Green Dot	Fed. 20S1	1155	11,000*
	⅞	Win. 209	14.5/Green Dot	Fed. 20S1	1155	10,500*
	⅞	CCI 209M	14.5/Green Dot	Fed. 20S1	1155	10,500*
	⅞	Fio. 616	14.5/Green Dot	Fed. 20S1	1155	10,500*
Case	Shot Wgt. in Oz.	Primer	—Powder— Grains/Type	Wad	Velocity fps	Pressure lup/psi*

For Skeet and Sporting Clays

28-Gauge — $2^3/_4$″ Shells

Case	Shot Wgt. in Oz.	Primer	—Powder— Grains/Type	Wad	Velocity fps	Pressure LUP/psi*
Federal Plastic Target	¾	Fed. 209	12.5/Green Dot	Rem. SP28	1200	12,000*
	¾	Fed. 209	13.5/Unique	Fed. 28S1A	1200	11,500*
	¾	Fed. 209	13.0/Unique	Rem. SP28	1200	11,200*
	¾	Fed. 209	13.5/Unique	Win. WAA28	1200	10,500*
	¾	CCI 109	13.0/Green Dot	Rem. SP28	1200	10,000*
	¾	CCI 109	13.5/Unique	Rem. SP28	1200	9,500*
	¾	CCI 109	14.0/Unique	Win. WAA28	1200	10,500*
	¾	Fed. 209	14.0/Herco	Fed. 28S1A	1200	11,700*
	¾	Fed. 209	13.0/Herco	Rem. SP28	1200	10,000*
	¾	Fed. 209	14.0/Herco	Win. WAA28	1200	11,000*
	¾	CCI 109	14.5/Herco	Rem. SP28	1200	10,000*
	¾	Fed. 209	17.5/Blue Dot	Fed. 28S1A	1200	9,500*
	¾	Fed. 209	18.0/Blue Dot	Rem. SP28	1200	10,000*
	¾	Fed. 209	17.5/Blue Dot	Win. WAA28	1200	8,700*
	¾	CCI 109	18.5/Blue Dot	Rem. SP28	1200	10,000*
	¾	Fed. 209	14.5/SR 7625	Rem. SP28	1200	10,500
	¾	Win. 209	15.0/SR 7625	Rem. SP28	1200	9,200
	¾	CCI 209	17.0/SR 4756	Fed. 28S1	1200	8,700
Case	Shot Wgt. in Oz.	Primer	—Powder— Grains/Type	Wad	Velocity fps	Pressure LUP/psi*

28-Gauge – 2¾″ Shells

Case	Shot Wgt. in Oz.	Primer	—Powder— Grains/Type	Wad	Velocity fps	Pressure LUP/psi*
Federal Plastic Target (continued)	¾	Fed. 209	16.0/SR 4756	Fed. 28S1	1200	10,000
	¾	Win. 209	17.5/SR 4756	Rem. SP28	1200	8,200
	¾	CCI 209M	14.5 /"Hi-Skor" 800-X	Fed. 28S1	1200	10,000
Remington Plastic Target	¾	Rem. 209P	14.5/Herco	Fed. 28S1A	1200	11,200*
	¾	Rem. 209P	14.0/Herco	Rem. SP28	1200	8,700*
	¾	Rem. 209P	14.0/Herco	Win. WAA28	1200	9,000*
	¾	CCI 109	14.5/Herco	Fed. 28S1A	1200	10,700*
	¾	CCI 109	14.0/Herco	Rem. SP28	1200	9,000*
	¾	CCI 109	14.0/Herco	Win. WAA28	1200	8,500*
	¾	Rem. 209P	13.5/Unique	Fed. 28S1A	1200	11,500*
	¾	Rem. 209P	13.0/Unique	Rem. SP28	1200	9,000*
	¾	Rem. 209P	13.0/Unique	Win. WAA28	1200	9,000*
	¾	CCI 109	14.0/Unique	Fed. 28S1A	1200	11,000*
	¾	CCI 109	13.0/Unique	Rem. SP28	1200	9,000*
	¾	CCI 109	13.0/Unique	Win. WAA28	1200	9,000*
	¾	Rem. 209P	12.0/Green Dot	Rem. SP28	1200	10,500*
	¾	Rem. 209P	12.0/Green Dot	Win. WAA28	1200	10,500*
Case	Shot Wgt. in Oz.	Primer	—Powder— Grains/Type	Wad	Velocity fps	Pressure LUP/psi*

Case	Shot Wgt. in Oz.	Primer	—Powder— Grains/Type	Wad	Velocity fps	Pressure LUP/psi*
Remington Plastic Target (continued)	3/4	CCI 109	13.0/Green Dot	Fed. 28S1A	1200	12,000*
	3/4	CCI 109	12.0/Green Dot	Rem. SP28	1200	10,200*
	3/4	CCI 109	12.0/Green Dot	Win. WAA28	1200	10,500*
Winchester Plastic AA Compression Formed	3/4	Win. 209	14.0/Herco	Win. WAA28	1200	8,500*
	3/4	CCI 109	14.0/Herco	Win. WAA28	1200	8,000*
	3/4	Win. 209	13.0/Unique	Win. WAA28	1200	9,500*
	3/4	CCI 109	13.0/Unique	Win. WAA28	1200	8,400*
	3/4	Win. 209	12.5/Green Dot	Win. WAA28	1200	12,000*
	3/4	Win. 209	17.5/540	Win. WAA28	1200	10,200
	3/4	CCI 109	17.5/540	Win. WAA28	1200	10,200
	3/4	Fed. 209	17.5/540	Win. WAA28	1200	10,200
	3/4	Win. 209	19.0/571	Win. WAA28	1200	10,000
	3/4	CCI 109	19.0/571	Win. WAA28	1200	10,500
	3/4	Win. 209	14.0 /"Hi-Skor" 800-X	Win. WAA28	1200	11,000
	3/4	CCI 209M	14.0 /"Hi-Skor" 800-X	Win. WAA28	1200	10,500
	3/4	Rem. 209P	15.5 /"Hi-Skor" 800-X	Fed. 28S1	1200	10,400
Case	Shot Wgt. in Oz.	Primer	—Powder— Grains/Type	Wad	Velocity fps	Pressure lup

410-Bore — 2½″ Shells

Case	Shot Wgt. in Oz.	Primer	—Powder— Grains/Type	Wad	Velocity fps	Pressure LUP/psi*
Federal Plastic	½	Fed. 209	13.5/Hercules 2400	Fed. 410SC	1200	12,000*
	½	Fed. 209	13.0/Hercules 2400	Rem. SP410	1200	11,500*
	½	Fed. 209	13.0/Hercules 2400	Win. WAA41	1200	11,500*
	½	Fed. 410	13.5/Hercules 2400	Fed. 410SC	1200	12,000*
	½	Fed. 209	15.5/IMR 4227	Rem. SP410	1125	11,000
	½	Fed. 209	15.5/IMR 4227	Fed. 410SC	1125	11,200
Remington Plastic	½	CCI 209M	13.5/Hercules 2400	Rem. SP410	1200	11,000*
	½	Rem. 209P	13.0/Hercules 2400	Rem. SP410	1200	11,500*
	½	Rem. 209P	13.5/Hercules 2400	Fed. 410SC	1200	11,500*
	½	Rem. 209P	14.0/Hercules 2400	Win. WAA41	1200	11,500*
	½	CCI 209	14.5/Hercules 2400	Rem. SP410	1200	10,500*
	½	CCI 209	14.0/Hercules 2400	Fed. 410SC	1200	10,500*

| Case | Shot Wgt. in Oz. | Primer | —Powder— Grains/Type | Wad | Velocity fps | Pressure LUP/psi* |

Case	Shot Wgt. in Oz.	Primer	—Powder— Grains/Type	Wad	Velocity fps	Pressure LUP/psi*
Remington Plastic (continued)	½	CCI 209	14.5/Hercules 2400	Win. WAA41	1200	10,500*
	½	Fed. 209	15.5/IMR 4227	Rem. SP410	1125	10,500
	½	Fed. 209	15.5/IMR 4227	Fed. 410SC	1125	10,500
	½	Win. 209	15.0/296	Rem. SP410	1200	9,500
Winchester Plastic AA Compression Formed	½	Win. 209	13.0/Hercules 2400	Win. WAA41	1200	11,700*
	½	CCI 209	13.5/Hercules 2400	Rem. SP410	1200	12,000*
	½	CCI 209	13.0/Hercules 2400	Fed. 410SC	1200	12,000*
	½	Win. 209	14.0/296	Win. WAA41	1200	10,000
	½	Win. 209	14.0/296	Fed. 410SC	1200	10,500
	½	CCI 109	14.0/296	Win. WAA41	1200	9,000
	½	CCI 109	14.0/296	Fed. 410SC	1200	10,000
	½**	Win. 209	13.5/296	Win. WAA41	1150	9,000
	½**	CCI 109	13.5/296	Win. WAA41	1150	8,500
Case	Shot Wgt. in Oz.	Primer	—Powder— Grains/Type	Wad	Velocity fps	Pressure LUP/psi*

** Loads may not function in semi-automatic shotguns.

BUCKSHOT AND SLUG LOADING TABLES

Introduction To Buckshot And Slugs

LOADING BUCKSHOT is not a common practice, and there are several good reasons for this. First, the number of buckshot rounds fired is relatively small each year. Often, the reloader will find that a year's supply of ammo can be had for far less than the cost of the minimum amount of components purchased.

Also, buckshot users most often want the very tightest patterns that can be had only from premium hard-plated pellets, which are difficult to find at most local reloading supply houses. Also, factory buffered buckshot loads will often outperform most handloads, even buffered ones, for a number of reasons.

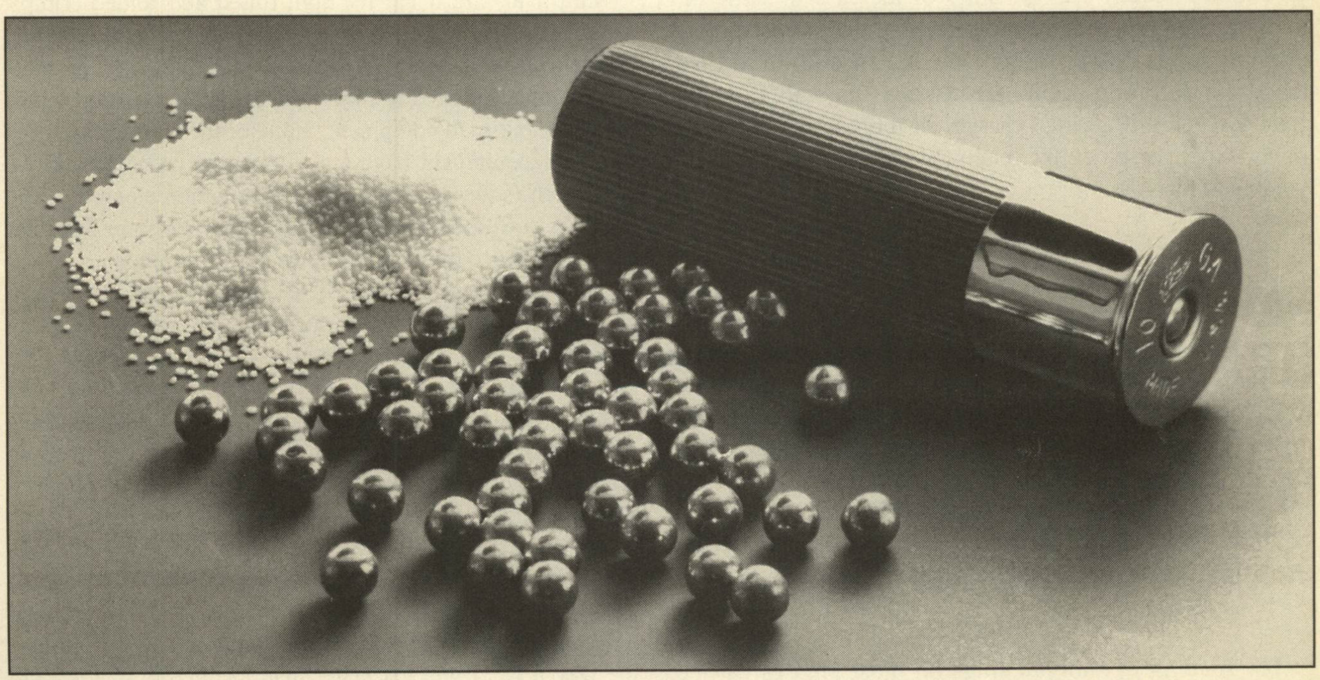
Still, some find a great deal of pleasure in assembling buckshot loads, even though the pellets must be hand-counted and then carefully placed into the case. In order to get all the pellets into a case, these loads often require the pellets to be layered. All this is a bit more than nettlesome, especially in light of the fact that the finished load will usually mean the hunter's effective range will be about 20 percent less than if factory ammo was used.

The spread of buckshot patterns is not always well understood. With choke and load optimizing, a typical 20-yard pattern might be about 10 inches in diameter. Theoretically, at 30 yards, patterns will open to 15 inches or more. Considering that a 15-inch pattern is the largest for clean kills on deer shot at broadside—and in the chest cavity—30 yards becomes the maximum range. However, when actually pattern testing at 30 yards, pellet spread routinely goes well beyond 15 inches. In fact, 25 yards is about maximum range with most loads and guns in order to maintain that 15-inch pattern spread. With reloads, the 15-inch pattern is often reached at only 20 yards, because of the shot used.

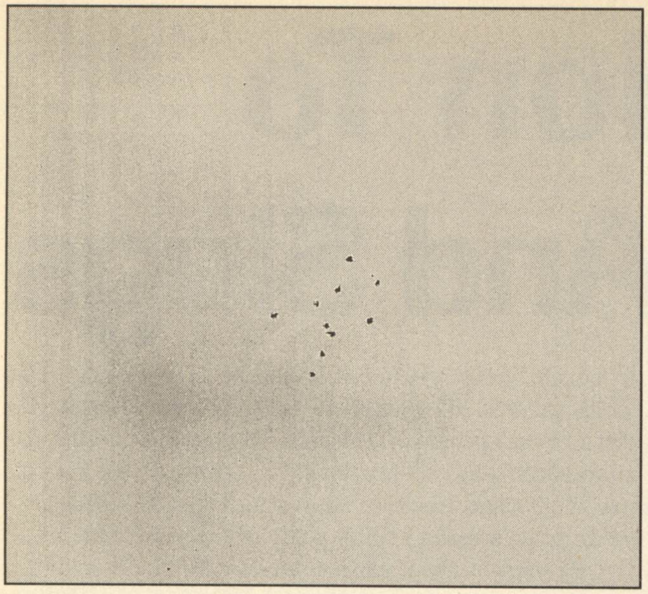
For the curious reloader, patterns at 50 yards are most often nearly 3 feet in diameter. With six to fifteen pellets (for the various 12-gauge 0, 00 and 000 buck) in a load, you can see why these loads would be inhumane at such long ranges. The likelihood of piercing a vital organ past 30 yards with a single pellet becomes a matter of random chance. And multiple pellets in the vitals are essential to bagging game.

Loading data for buckshot may not exactly match the factory-load pellet count. The number of pellets specified in our data must be used exactingly. Never attempt to increase pellet count.

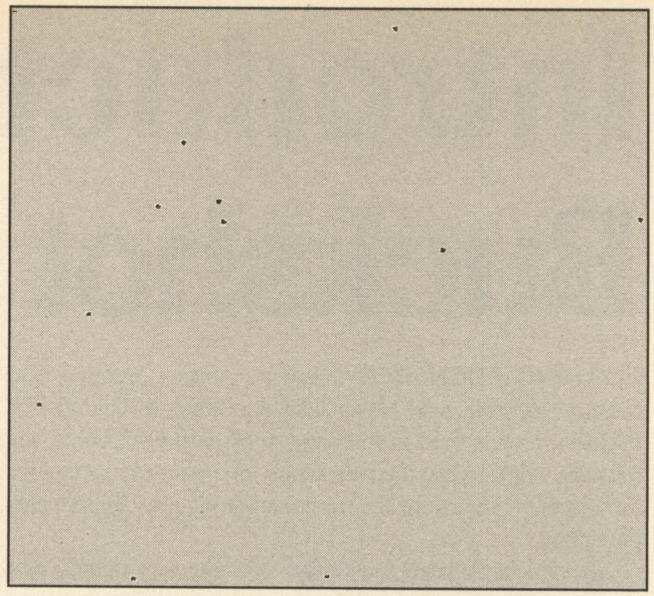
Because of the need to maintain very tight patterns with



The performance of factory-loaded buckshot is extremely hard to duplicate with reloads.



This is a 20-yard pattern, of about 6 inches in diameter, using factory-loaded Winchester buckshot. The reloader will be doing about average if patterns are 2 to 3 times as large at the same range.



At 50 yards, buckshot patterns become too large to be useful. This one, obtained with a factory load, has an extreme spread of 31 inches.

buckshot, it was decided to list several loads using buffering material. It is essential when using data for buffered loads that only the exact brand and weight of the specified buffering agent be used. This means there can be no substitutions, regardless of what some uniformed dealer might say about buffer similarity. And, it means the very careful weighing of each charge of buffer.

When loading buffered loads, first place the buckshot into the case. Buckshot pellets must be hand-counted. Never attempt to volume-meter buckshot. Next, pour in the carefully weighed buffer. Tap the sides of the case to settle the buffer about flush with the top surface of the pellets. Do not attempt to create additional settling or add additional amounts. Buffering agents greatly alter the ballistics and fluid dynamics of the shot charge, far more than some folks might expect based on the relatively light weight and small volume of material.

Wads

It was necessary to use filler wads to develop our buckshot data. The wads generally used by reloaders were never intended for buckshot, and their cup capacity must be altered to best suit the various loads. When inserting filler wads, be certain they bottom in the shot cup. A small diameter dowel works well as a seating tool. Always insert the wads in the order listed—the first wad listed is placed into the case first and will be the bottom of the wad column. Card and fiber wads are selected to match the gauge being loaded, except when a smaller gauge wad is specified for use as a filler in a shot cup.

Slugs

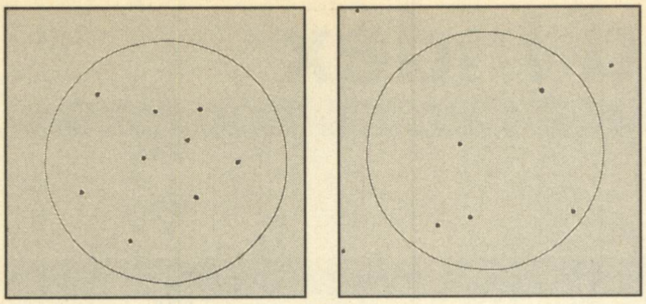
The loading of shotgun slugs on most presses can be tedious. Each slug must be individually placed into the case and seated firmly on the powder charge. The use of an appropriate dowel will be necessary. **Note:** *The Brenneke slug listed in the data has a wad column screwed to its base. Any wads listed in the data for Brenneke slugs are additional wads beyond those screwed to the base of the slug.*

A wad pressure of 40 pounds should be applied to each wad as it is placed into the case. Any attempt to loosely place wads into the case, and then apply pressure to the top of the wad column, can result in varying, even unsafe, performance. The wads listed must be used exactly as to brand, type and dimensions.

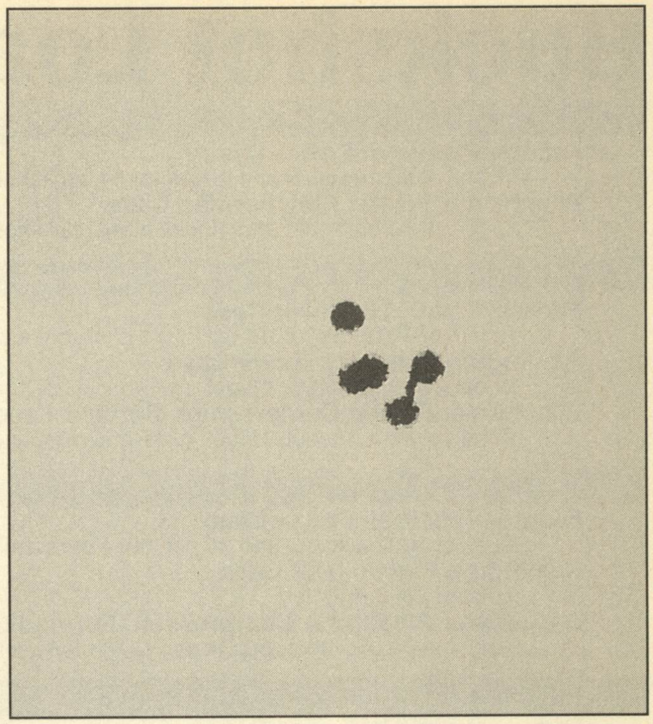
Slug loads are listed for both rolled and folded crimps. This part of the recipe is essential, so do not substitute one crimp type for another. We realize that roll crimping tools are no longer generally marketed and have no suggestions for obtaining such equipment. None of the manufacturers of the older equipment have any such units on hand, and we have been requested to pass this information along to avoid needless correspondence. The roll crimp loads are listed for the convenience of those who own such equipment.

In more than forty years of reloading, I have never been able to duplicate the slug performance of factory loads, not even those of a few decades back. The likelihood of a reloaded slug coming close to factory performance is small—even remote. Therefore, we strongly urge that the accuracy of slug reloads be carefully evaluated before going hunting. Seldom will the necessary 6-inch group be obtained with a reloaded slug at any range past 45 to 50 yards.

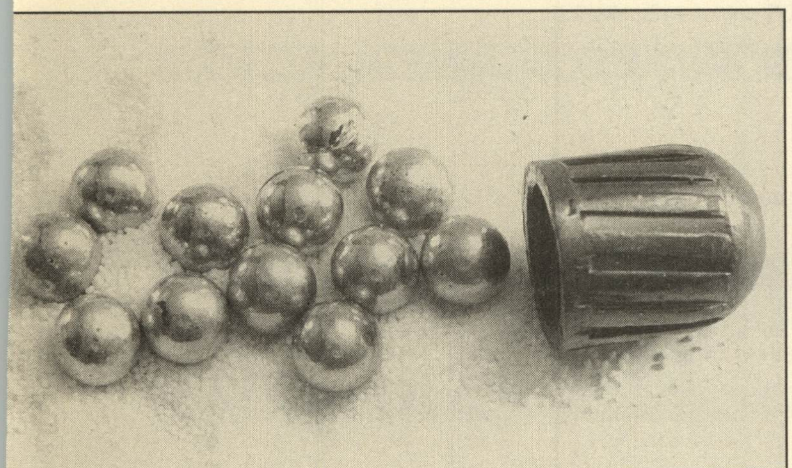
We realize that our comments on the reloading of buckshot and slugs is more than somewhat negative. However, this is the state of the art. Rather than having a disgruntled reader write to tell of inferior performance, we have told it the way it is. If you get better than average results, we are happy for you. If your results are entirely unsatisfactory, we suggest the use of factory ammo.



The advantage of hard buckshot and buffering are obvious in this comparison of a Federal Premium factory load versus a standard buckshot load.



Accuracy with slugs like this $2^1/_3$-inch, five-shot, 50-yard group is hard to realize with reloads.



Factory buckshot and slugs are highly refined with respect to performance, and most reloaders will be unable to duplicate their performance.

About The Data

Do not attempt to use any data until all of the preceding material in this book has been carefully read and is fully understood. Reloading demands a great deal of knowledge and understanding. It is not possible to simply purchase a reloading tool, select a load from the data and then expect that assembled ammunition will be safe and fit for specific applications.

Caution: *The data contained in this section is intended for use only by experienced shotshell reloaders, and are supplied for comparative purposes only. It is the reloader's responsibility to ensure the safety and suitability of any and all ammunition assembled. It is also the reloader's responsibility to use only the latest reference material. The information in these pages will become obsolete and should no longer be referenced as soon as a later edition is published, or when any manufacturer changes the ballistic properties of any listed component, or when any component manufacturer alters any published data.*

Pressure Listings

Pressure listings are given in both LUP and psi, depending upon when the data was tested and what system was used to record pressures. LUP and psi readings *cannot* be directly compared.

Caution

When assembling buffered buckshot loads, the reloader must exercise extreme care. Place the exact count of pellets of the specified size into the case. Then add only the exact weight of buffering as specified in the following data. Never attempt to substitute one brand of buffering for another. Never attempt to meter buffering material by volume measure. Differences in types of granulated polyethylene can be as great as the differences in speeds of propellant. Pour the carefully weighed buffer on top of the pellets. Settle the buffer, if required, by tapping the side of the case until it is about level with the top surface of the upper pellets in the case. Then crimp in the normal fashion. The misuse of buffering agents can be extremely hazardous and can cause property and personal injury, even death.

Never substitute one size buckshot for another. This should not be done even on a weight-for-weight basis as dangerous ballistics could occur. Never attempt to use any standard pellet size, not even the larger sizes—BBB, T, TT, F (TTT), or FF—with buckshot data. Never load any steel pellets with the buckshot data that follows.

All buckshot data is for use only with six- or eight-point folded crimps. Do not use any of the following buckshot data with roll crimps, unless specified.

Pattern testing of all buckshot loads in the specific shotgun to be used is strongly suggested. Not every reloader will be satisfied with the performance of reloaded buckshot. Invariably, some shortening of practical range will be required when reloads are used.

Buckshot Load Index

10-Gauge 3½″ Shells

12-Gauge 3″ Shells

12-Gauge 2¾″ Shells

Buffered 12-Gauge 2¾″ Shells

20-Gauge 3″ Shells

20-Gauge 2¾″ Shells

Slug Load Index

12-Gauge 3″ Shells (Rolled Crimp)

12-Gauge 2¾″ Shells (Rolled Crimp)

12-Gauge 2¾″ Shells (Folded Crimp)

20-Gauge 2¾″ Shells (Folded Crimp)

Buckshot Load Data

10-Gauge — $3\frac{1}{2}''$ Shells

Case	Buckshot Ct./Size	Primer	—Powder— Grains/Type	Wad	Velocity fps	Pressure LUP/psi*
Federal Plastic Hi Power	17/#0	Fed. 209	46.0/Blue Dot	Rem. SP10 One .135" 20 ga. cards/BSC	1300	10,000*
	40/#4	Fed. 209	45.0/Blue Dot	Rem. SP10 Two .135" 20 ga. cards./BSC	1275	10,000*
Winchester Plastic Poly Formed	17/#0	Win. 209	51.0/Blue Dot	Rem. SP10	1300	9,500*
	40/#4	Win. 209	47.5/Blue Dot	Rem. SP10 Two .135" 20 ga. cards/BSC	1275	10,000*
Case	Buckshot Ct./Size	Primer	—Powder— Grains/Type	Wad	Velocity fps	Pressure LUP/psi*

BSC = Inserted into bottom of shot cup.

12-Gauge — 3″ Shells

Case	Buckshot Ct./Size	Primer	—Powder— Grains/Type	Wad	Velocity fps	Pressure LUP/psi*
Federal Plastic Hi Power	12/#0	Fed. 209	31.5/Herco	Rem. RP12 One .200" 20 ga. card/BSC	1275	10,000*
	18/#1	Fed. 209	36.0/Blue Dot	BP Gas Seal and Shot Cup	1225	9,500*
	33/#4	Fed. 209	37.0/Blue Dot	BP Gas Seal and Shot Cup	1250	10,500*
Remington Plastic Unibody	12/#0	Rem. 209P	29.5/Herco	Rem. RP12 One .200" 20 ga. card/BSC	1275	10,000*
	18/#1	Rem. 209P	35.5/Blue Dot	BP Gas Seal and Shot Cup	1225	10,000*
	33/#4	Rem. 209P	46.0/Hercules 2400	BP Gas Seal and Shot Cup	1250	9,500*
Winchester Plastic Compression Formed	12/#0	Win. 209	37.5/Blue Dot	Rem. RP12 One .200" 20 ga. card/BSC	1275	10,000*
	18/#1	Win. 209.	50.5/Hercules 200	BP Gas Seal and Shot Cup	1300	9,000*
	18/#1	Win. 209	34.5/Blue Dot	BP Gas Seal and Shot Cup	1225	10,000*
	33/#4	Win. 209	49.0/Hercules 2400	BP Gas Seal and Shot Cup	1300	10,000*
Case	Buckshot Ct./Size	Primer	—Powder— Grains/Type	Wad	Velocity fps	Pressure LUP/psi*

BP = Ballistic Products; BSC = Inserted into bottom of shot cup.

12-Gauge — $2\frac{3}{4}''$ Shells

Case	Buckshot Ct./Size	Primer	—Powder— Grains/Type	Wad	Velocity fps	Pressure LUP/psi*
Federal Plastic Hi Power	9/#00	Fed. 209	30.0/Herco	One .135" card wad One ¼" fiber wad One 3/16" fiber wad One ½" fiber wad	1325	9,500*
	34/#4	Fed. 209	37.0/Blue Dot	One .135" card wad One 3/16" fiber wad One .135" card wad	1250	10,500*
Remington Plastic RXP	9/#00	Rem. 209P	29.0/Herco	One .135" card wad One ¼" fiber wad One 3/16" fiber wad	1325	10,000*
Winchester Plastic AA Compression Formed	9/#00	Win. 209	30.0/Herco	One .135" card wad Two ¼" fiber wads	1325	10,000*
	34/#4	Win. 209	39.0/Blue Dot	One .135" card wad One 3/16" fiber wad One .135" card wad	1250	11,000*
Case	Buckshot Ct./Size	Primer	—Powder— Grains/Type	Wad	Velocity fps	Pressure LUP/psi*

12-Gauge $2\frac{3}{4}''$ Shells (Buffered)

Case	Shot Ct./Size	Primer	—Powder— Grains/Type	Wad	Velocity fps	Pressure LUP/psi*
Federal Plastic Hi Power	6/#000	Fed. 209	23.0/"Hi-Skor" 700-X	Four BP Gas Seals Plus 20 grains of BPSB	1400	10,500
	8/#00	Fed. 209	20.5/"Hi-Skor" 700-X	Fed. 12S4 Plus 20 grains of BPSB	1275	10,500
	10/#0	Fed. 209	20.5/"Hi-Skor" 700-X	Rem. 12SP Plus 20 grains of BPSB	1225	10,500
	12/#1	Fed. 209	21.0/"Hi-Skor" 700-X	Fed. 12S4 Plus 20 grains of BPSB	1300	11,000
	22/#3	Fed. 209	20.5/"Hi-Skor" 700-X	Rem. SP12 Plus 20 grains of BPSB	1225	10,500
	24/#4	Fed. 209	20.5/"Hi-Skor" 700-X	Rem. SP12 Plus 20 grains of BPSB	1225	10,500
Case	Shot Ct./Size	Primer	—Powder— Grains/Type	Wad	Velocity fps	Pressure LUP/psi*

BPSB = Ballistic Products Shot Buffer; BP = Ballistic Products.

20-Gauge — 3″ Shells

Case	Buckshot Ct./Size	Primer	—Powder— Grains/Type	Wad	Velocity fps	Pressure LUP/psi*
Federal Plastic Hi Power	21/#3	Fed. 209	26.0/Blue Dot	Rem. SP20	1225	8,000*
	18/#3	Fed. 209	19.5/Herco	Rem. RXP20	1225	8,500*
Winchester Plastic AA Compression Formed	18/#3	Win. 209	19.0/Herco	Win. WAA20F1	1225	9,500*
Case	Buckshot Ct./Size	Primer	—Powder— Grains/Type	Wad	Velocity fps	Pressure LUP/psi*

20-Gauge — 2¾″ Shells

Case	Buckshot Ct./Size	Primer	—Powder— Grains/Type	Wad	Velocity fps	Pressure LUP/psi*
Federal Plastic Hi Power	18/#4	Fed. 209	19.0/Herco	Rem. SP20	1275	11,000*
	18/#4	Fed. 209	25.0/Blue Dot	Rem. SP20	1275	9,500*
Winchester Plastic AA Compression Formed	18/#4	Win. 209	24.0/Blue Dot	Rem. SP20	1275	9,500*
Case	Buckshot Ct./Size	Primer	—Powder— Grains/Type	Wad	Velocity fps	Pressure LUP/psi*

Slug Load Data

12-Gauge — 3″ Shells (Roll Crimp)

Case	Slug Type/Wgt.	Primer	—Powder— Grains/Type	Wad	Velocity fps	Pressure LUP/psi*
Federal Plastic Hi Power	Bren./ 1 oz.	Fed. 209	45.0/Blue Dot	Two .135" card One $\frac{3}{8}$" fiber wad	1525	10,500*
Remington Plastic Unibody	Bren./ 1 oz.	Rem. 209P	56.5/Hercules 2400	Two .135" card One $\frac{3}{8}$" fiber wad	1525	10,000*
Winchester Plastic AA Compression Formed	Bren./ 1 oz.	Win. 209	57.5/Hercules 2400	Two .135" card One $\frac{3}{8}$" fiber wad	1525	9,500*
Case	Slug Type/Wgt.	Primer	—Powder— Grains/Type	Wad	Velocity fps	Pressure LUP/psi*

Bren. = Brenneke.

12-Gauge — 2¾″ Shells (Roll Crimp)

Case	Slug Type/Wgt.	Primer	—Powder— Grains/Type	Wad	Velocity fps	Pressure LUP/psi*
Federal Plastic Hi Power	Bren./ 1 oz.	Fed. 209	37.0/Herco	One .135" card wad Two $\frac{1}{4}$" fiber wads	1575	10,500*
Winchester Plastic AA Compression Formed	Bren./ 1 oz.	Win. 209	37.0/Herco	One .135" card wad Two $\frac{3}{16}$" fiber wads	1575	9,500*
Case	Slug Type/Wgt.	Primer	—Powder— Grains/Type	Wad	Velocity fps	Pressure LUP/psi*

Bren. = Brenneke.

12-Gauge — 2¾″ Shells (Fold Crimp)

Case	Slug Type/Wgt.	Primer	—Powder— Grains/Type	Wad	Velocity fps	Pressure LUP/psi*
Federal Plastic Hi Power	Bren./ 1 oz.	Fed. 209	20.5/"Hi-Skor" 700-X	Two .220" card	1225	10,500
	Bren./ 1 oz.	Fed. 209	19.0/"Hi-Skor" 700-X	Two BP Gas Seals	1225	10,500
	Bren./ 1 oz.	Fed. 209	28.0/PB	One .135" card wad One .080" card wad	1350	10,500
	Bren./ 1 oz.	Fed. 209	27.0/PB	One BP Gas Seal	1400	10,500
	Bren./ 1 oz.	Fed. 209	31.0/SR 7625	One BP Gas Seal	1450	10,500
	Bren./ 1 oz.	Fed. 209	37.0/SR 4756	One BP Gas Seal	1525	10,500
Case	Slug Type/Wgt.	Primer	—Powder— Grains/Type	Wad	Velocity fps	Pressure LUP/psi*

Bren. = Brenneke; BP = Ballistic Products.

20-Gauge — 2¾″ Shells (Fold Crimp)

Case	Slug Type/Wgt.	Primer	—Powder— Grains/Type	Wad	Velocity fps	Pressure LUP/psi*
Federal Plastic Hi Power	Bren./ 370-gr.	Fed. 209	14.0/"Hi-Skor" 700-X	Four .135" card	1125	11,000
	Bren./ 370-gr.	CCI 209M	14.0/"Hi-Skor" 700-X	Four .135" card	1125	10,500
	Bren./ 370-gr.	Fed. 209	17.5/PB	Three .135" card	1200	10,500
	Bren./ 370-gr.	CCI 209M	18.0/PB	Three .135" card	1200	10,500
	Bren./ 370-gr.	Fed. 209	20.5/SR 7625	Three .135" card	1300	11,000
	Bren./ 370-gr.	CCI 209M	21.5/SR 7625	Three .135" card	1325	11,000
	Bren./ 370-gr.	Win. 209	24.5/SR 4756	Two .135" card	1350	10,500
	Bren./ 370-gr.	CCI 209M	25.5/SR 4756	Two .135" card	1400	
Case	Slug Type/Wgt.	Primer	—Powder— Grains/Type	Wad	Velocity fps	Pressure LUP/psi*

Bren. = Brenneke.

STEEL SHOT LOADING

Introduction To Steel Shot

STEEL SHOT CREATES unique loading problems for ammunition makers: permissible firearms, pellet hardness, propellant requirements, unique wads, case capacity, choking and more. It is *essential* that nothing said previously in this book be construed as applying (or not) to steel pellet shotshell loads, except if specifically stated. Never use any of the data in this book with steel pellets, wads or cases designed by the manufacturer specifically for steel shot.

Hardness

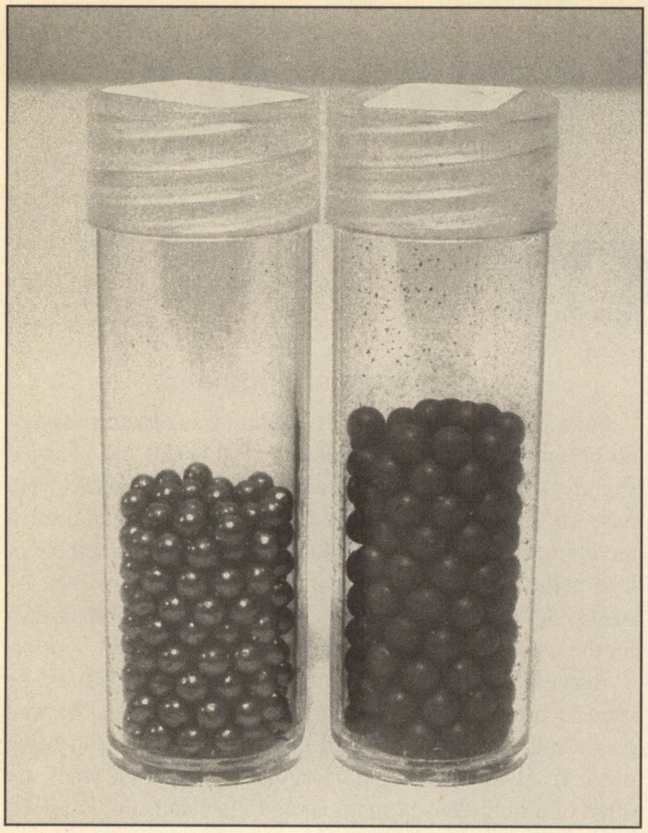
Steel shotshell pellets must have a diamond pyramid hardness no greater than 90. Some steel pellets, at least at one time, were sold for reloading despite the fact they were a great deal harder than the maximum allowable limit. These are essentially dangerous to use and very ruinous to a shotgun barrel. The reloader who assembles steel shot loads has to be careful of steel pellet quality. But, steel pellets are not the only concern.

Steel Loading Problems

For a long time, steel pellet reloading was considered a no-no by *every* conscientious reloader. While this has changed slightly, the concerns of then and now are, nonetheless, very real. To begin, factory-loaded steel pellet ammunition often incorporates a case that is unlike any used for the assembly of lead pellet loads. This is because the relatively low-density steel pellets require a lot of extra room in the case. Thus, data for these cases will be unique to them.

Because steel pellets are so hard, special wads must be used to prevent the pellets from rubbing through the wad petals and scoring the bore of the shotgun. Instead of being made from low-density polyethylene, steel shot wads are often of a high-density material and the petals are up to 100 percent thicker than those of lead pellet wads. This extra thickness compounds the problem of available space in the case. To offset some of the volume problem, most steel pellet wads have no collapsible leg section.

Waterfowl hunting was once the nearly exclusive domain of heavy charges of large lead pellets—#4s and #2s in 1½-ounce or heavier loadings. Today, steel shot has been mandated for all waterfowl hunting. Steel pellets of sizes #2, #1, B and BB are generally used, though even larger pellets of F and T sizes are employed by some, where legal. And because of steel's low density, 12-gauge shells have grown to a 3½-inch length in order to get reasonable shot charge weights into the case.



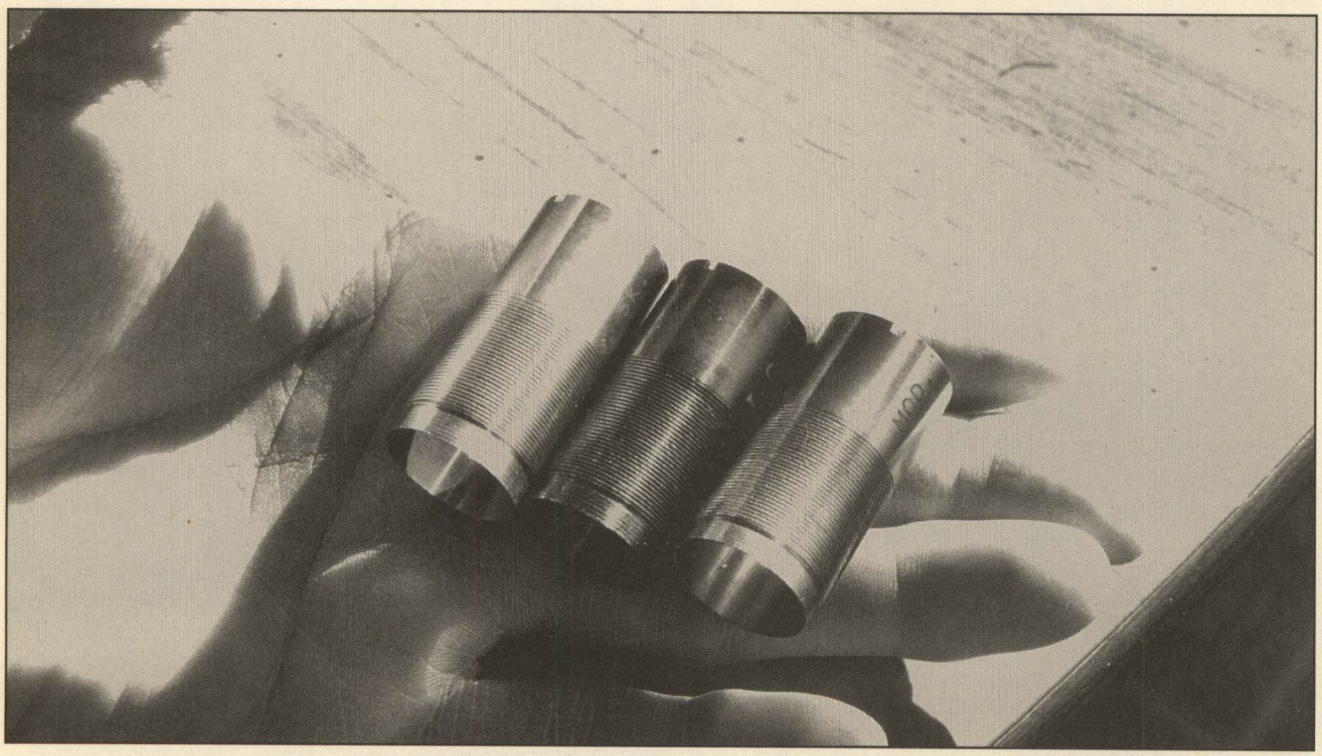
Here are two containers comparing lead versus steel pellet density. The one on the left contains $1^3/_8$ ounces of lead #4 pellets. The one on the right contains a lighter charge of $1^1/_4$ ounces of steel #2 pellets. If density alone was not enough of a problem, steel requires the selection of pellets about two to three sizes larger to maintain downrange ballistics and penetration.

Caution: *It is essential that the entire steel shot column be contained fully within the wad's shot cup. Steel pellets will not set back, and if any pellets contact the bore, the barrel will be severely damaged.*

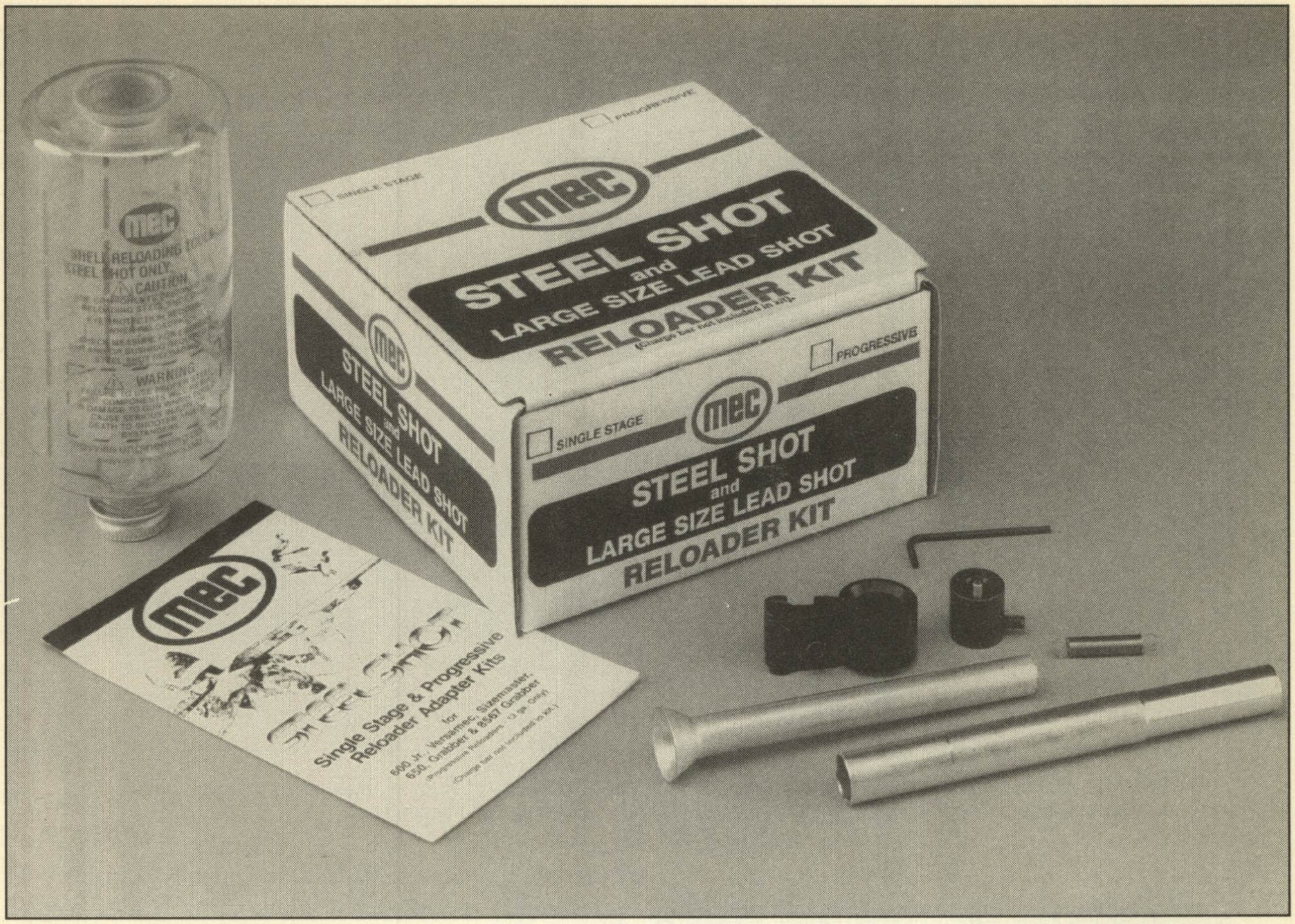
Generally, steel wads are simply a shot cup with an obturating lip at the base. This creates unique pressure/time curves necessitating specially blended propellants to optimize ballistics. Also, the steel pellet charge is not nearly as fluid as a lead charge, and this also creates special internal ballistic problems best handled with unique propellants.

Steel pellets also demand very special barrel strength; the same for the hardness and strength of interchangeable choke tubes. Even when the correct barrel and choke tube parameters are present, steel pellets can eventually ruin both. Barrel choke areas and/or the removable choke tubes can eventually begin to bulge with the use of steel pellets. This problem is aggravated as the shot size becomes larger. Thus, steel shot users must be selective about the guns used to fire this kind of ammo.

Attempts to load steel pellets with the available speeds of canister propellants usually means accepting considerably lower velocities than can be had from factory ammo. The factories simply have more propellant possibilities available to them. Also, steel shot reloading has not become popular enough to justify independent manufacturers making available more than but a few suitable wads. In addition, the ammo makers have chosen not to sell steel components to the reloader. And there is another obstacle: Many existing shotshell reloading presses will not handle steel pellets. The presses can bind up solidly and be damaged if steel pellets are used in them.



The user of steel shot must be certain the gun used is compatible with this style ammo. Even choke tubes must meet the test of suitability for use with steel. If in doubt, contact the manufacturer of the gun and/or choke tubes.



This is MEC's basic lead to steel conversion kit. It includes a specially dimensioned shot bottle, drop tube and metering tube. Also included are a special wad guide and instructions.

Making a difficult problem even more so, the canister propellant marketers and manufacturers have decided unanimously (but independently) not to supply any reloading data for steel pellet loads. Perhaps this is rightly so, as there are even more concerns for safety than those already mentioned. For example, steel can rust, rust can lead to fusing of pellets and this can lead to abnormal internal ballistics—to dangerous levels.

Generally, slower burning propellant speeds are required for assembling steel pellet loads. Even then, it is not usually possible to duplicate factory steel shotshell velocities when using currently available canister speeds. This means reduced effective range. Also, often it is not possible to duplicate the shot charge weights of factory loads, and this means a further reduction in effective range. Thus, the steel pellet reloader must drastically reduce the range at which he shoots.

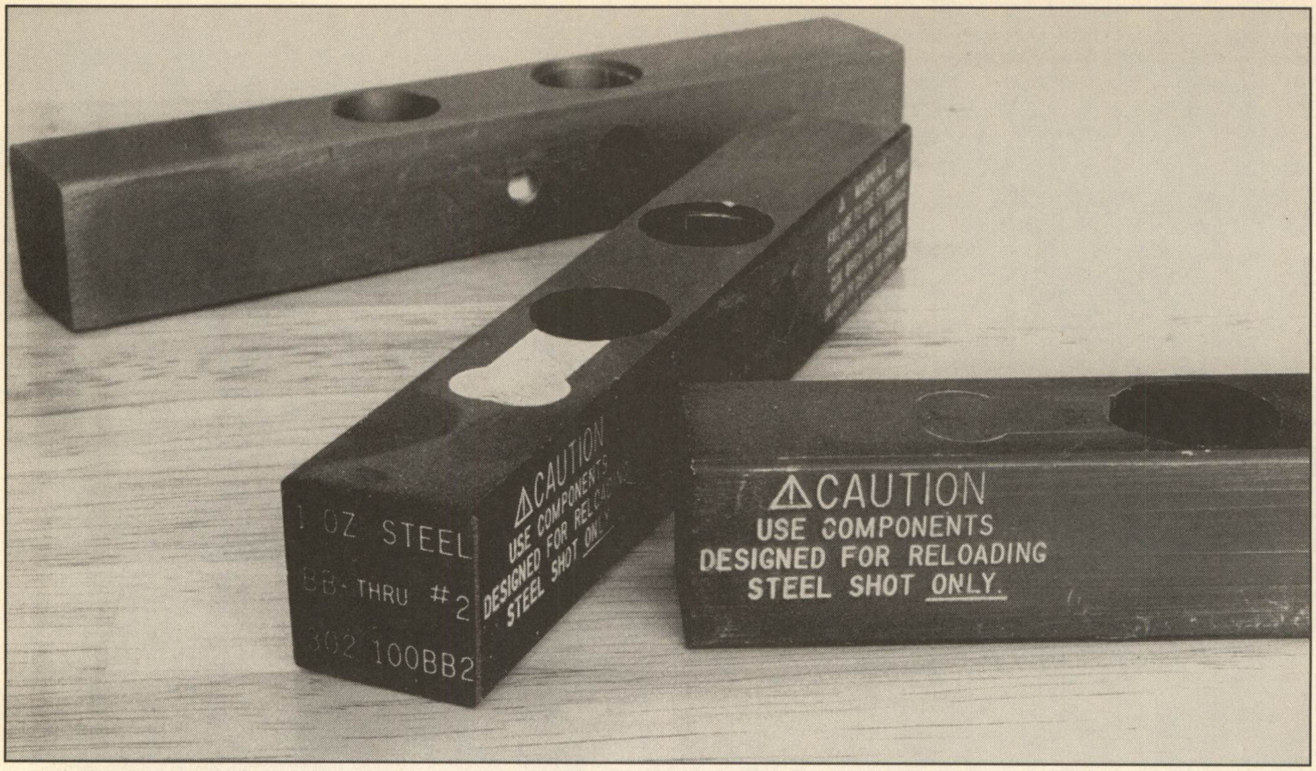
All this leaves the reloader in a quandary. First, suitable components must be located, then appropriate data is required, and finally the loading press may need to be altered. Since this last requirement can be beneficial to shotshell reloading, we will discuss it first.

In general, steel pellets will not wipe away or be cut off at the edge of the shot metering surfaces. Because of this, manufacturers have altered these surfaces in specific tools (or conversion units for existing tools) to be used with steel pellets. On MEC tools and conversion parts, there is an insert in the shot metering bar that is compressible. Pellets that might otherwise cause damage can be temporarily moved out of the way with this setup. Because of steel's low density, special metering bars or bushings are also required. This need is so pronounced that makers offer metering bars for specific pellet sizes.

Other tool changes include the need for longer drop tubes and shot metering tubes of a substantially larger internal diameter to prevent shot bridging with the larger pellets common to steel pellet use. The addition of all these parts are always an aid when reloading large diameter lead pellets.

Several makers offer steel pellet loading tools all set up and ready to go. The purchase of one of these, along with appropriate accessory lead shot bars and powder bushings, would make a very versatile reloading setup for both steel and lead.

Having purchased a suitable tool, or made the necessary conversions, a source of steel pellets must be located. One such is MEC, which offers steel shot in a wide range of pellet sizes. They also sell a number of steel pellet wads.



Special shot metering bars are essential for loading steel pellets. Also, such bars are often made to accommodate only specific size pellets. Change pellet size and you may have to change the metering bar.

TABLE I

Steel Pellets Versus Lead Pellets

Pellet Size	Diameter (ins.)	Pellets Per Ounce* Steel	Lead
000 Buck	.36	-	7
00 Buck	.33	-	8
0 Buck	.32	-	9
1 Buck	.30	-	10
2 Buck	.27	-	14
3 Buck	.25	-	18
4 Buck	.24	-	21
FF	.23	-	23
F (TTT)	.22	39	25
TT	.21	46	29
T	.20	52	34
BBB	.19	62	42
BB	.18	72	50
B	.17	87	60
1	.16	103	72
2	.15	125	87
3	.14	154	106
4	.13	192	135
5	.12	243	170
6	.11	317	225
7	.10	-	299
7½	.095	-	345
8	.09	-	405
8½	.085	-	480
9	.08	-	585
10	.07	-	850
11	.06	-	1350
12	.05	-	2335
Dust	.04	-	4565

*Exact pellet count varies with pellet hardness/density.

However, no special propellants are currently available from any source. Standard propellants are currently used at some sacrifice in terminal ballistics.

Shot Size Selection

Much has been written about the choice of steel pellet sizes. Generally speaking, the ammo industry is recommending the use of steel pellets at two sizes larger than lead pellets. For example, if you have been happy with the performance of lead #4s for pheasant and duck, the appropriate steel shot size is supposed to be #2s. This thinking is backed up with the relative energy figures of steel pellets versus lead. This reasoning is fairly borne out when making actual pellet weight comparisons. See Table III for the nearest weight comparisons. If velocities and weights are similar, naturally energies will be similar. In the proximate tables, a few lead sizes are listed twice because it is a toss-up matching weights with steel pellets. The same applies when comparing pellet counts. Two sizes larger comes close to being a match quite often. But there are a few catches, and these will be addressed later.

Performance Differences

When comparing the performance of steel pellets (two sizes larger than lead pellets) on waterfowl, many hunters are noting that the game cannot be bagged as cleanly or at the same ranges. What is overlooked is that the larger steel pellet requires more energy to achieve the same depth of penetration. This is because its large frontal area results in quicker energy loss.

After firing thousands of rounds at waterfowl with steel, I

TABLE II

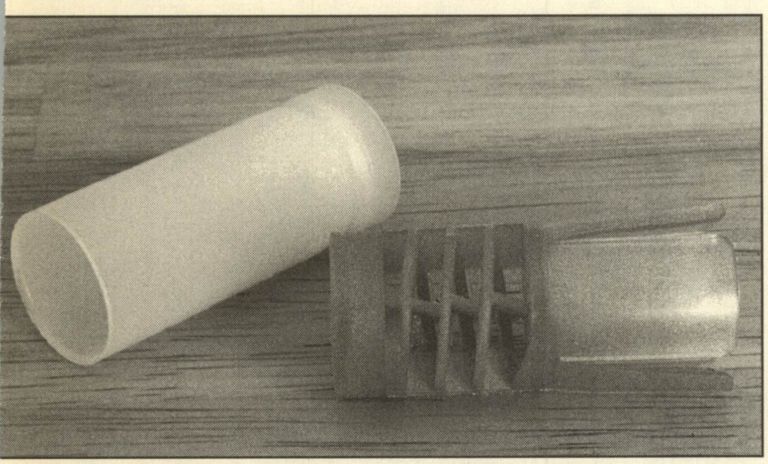
Steel Shot Ballistic Data				
Shot Size	Min. Oz. Shot	Pellet Count	Max. Sugg. Range*	Sugg. Choke
4	1	192	25	I.C.
3	$1^1/_8$	173	30	I.C.
2	$1^1/_4$	156	35	Mod.
1	$1^3/_8$	141	40	Mod.
B	$1^9/_{16}$	135	45	Full
BB	$1^3/_4$	126	50	Full

*Range can be increased about 3 yards for each additional $^1/_8$ ounce of shot. Range can be increased about 3 yards by using the next lighter choking.

TABLE III

Lead Versus Steel Pellet Weight			
—Lead Pellet—		—Steel Pellet—	
Size	Wgt. Grs.	Size	Wgt. Grs.
BBB	10.4	F (TTT)	11.0
BB	8.8	TT	9.6
BB	8.8	T	8.3
B	7.3	BBB	7.1
1	6.1	BB	6.1
2	5.0	B	5.0
3	4.1	1	4.3
4	3.2	2	3.5
5	2.6	3	2.9
5	2.6	4	2.3
6	1.9	5	1.8
$7^1/_2$	1.3	6	1.4

When purchasing steel shot components, choose those available from a reliable manufacturer and which are supported by data. MEC is one such source. They offer both wads and steel shot.



A typical steel shot wad (left) compared to a lead shot wad.

am convinced that the best rule of thumb is to select a steel pellet three sizes larger than the proven lead pellet size. However, the pellet count penalty will result in less dense patterns. Despite the characteristic of steel to pattern tighter (the pellets are not deformed in the barrel), there is not enough patterning gain to make up the difference in pellet count. Therefore, when using steel shot in the field, I use a pellet three sizes larger and shorten up the maximum range to compensate for pattern density loss. Ranges should be reduced by at least 10 yards, but 15 would be better.

Many reloaders have found that a 12-gauge $2^3/_4$-inch magnum load of $1^1/_2$ ounces of lead #4s is the ideal load for most duck hunting. This would mean that steel #1s should now be selected. Since there are 202 pellets in that lead load, it would take a full 2 ounces of steel #1s to supply equal pattern density with 206 pellets. The heaviest 3-inch 12-gauge steel shot load has only $1^3/_8$ ounces of #1 shot, or 141 pellets.

With about a one-third decrease in pellet count, it is reasonable to decrease maximum range by a third and to add back a bit for steel's slightly superior patterning. Subjectively, reducing maximum range by 25 percent for this steel shot load seems to keep hits versus kills on a good level. For most, that means dropping from 55 to 40 yards with the mentioned loads.

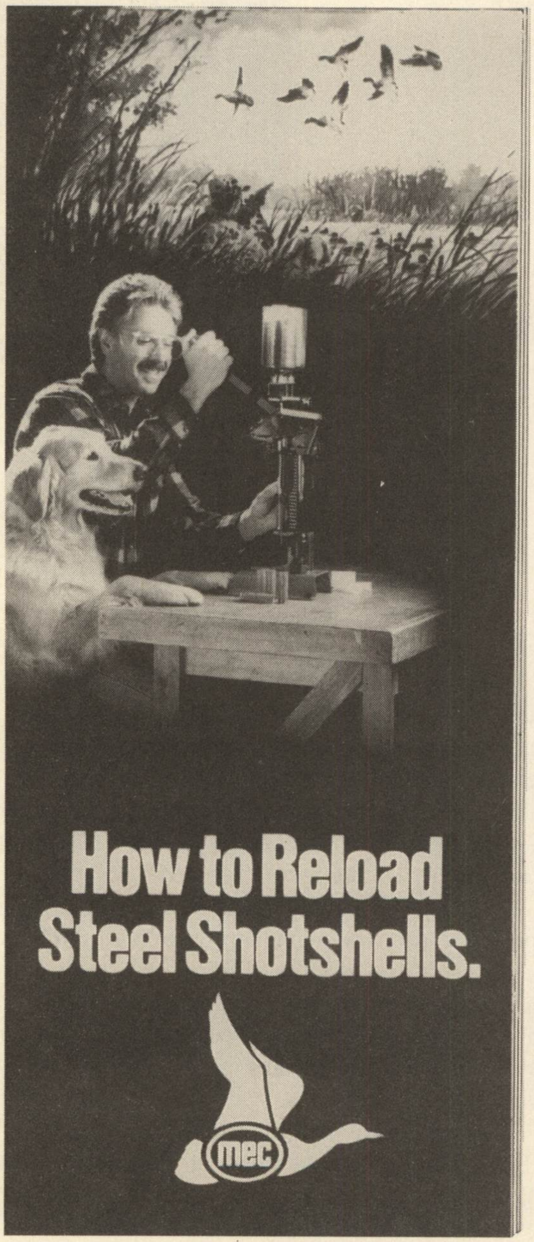
The new $3^1/_2$-inch 12-gauge load has $1^9/_{16}$ ounces of steel #1s, or 161 pellets. Even here, it makes sense to keep the maximum range at no more than 45 yards. A 10-gauge steel load with $1^3/_4$ ounces of steel #1s has 180 pellets. That's still not as many as the short magnum 12-gauge $1^1/_2$-ounce lead #4 load, but enough to bring the maximum range to

TABLE IV

Equal Pellet Count Comparisons

Steel Pellet Size	Steel Pellet # per oz.	Lead Pellet Size	Lead Pellet # per oz.
F (TTT)	39	T	34
TT	46	BBB	42
T	52	BB	50
BBB	62	B	60
BB	72	1	72
B	87	2	87
1	103	3	106
2	125	4	135
3	154	5	170
4	192	6	225
5	243	6	225
6	317	7	299

This photo of the author and a goose killed with steel shot was taken more than 10 years ago (no kidding). While he has been taking game for more than a decade with steel pellets, he feels that steel shot reloading has not yet come of age on a needed performance basis.



MEC offers a free data book for use with their steel shot and steel shot wads.

TABLE V

Typical Leads for Steel Shot Loads and Waterfowl Crossing at Right Angle

MV (fps)	Shot Size	Lead in Feet at Range 30 yds.	40 yds.	50 yds.
12-gauge, 3-inch, $1^1/_4$-ounce				
12-gauge, $2^3/_4$-inch, $1^1/_8$-ounce				
1375/1365	BB	4.7	6.7	9.0
	1	4.8	6.9	9.3
	2	4.8	7.0	9.5
	3	4.9	7.1	9.7
	4	5.0	7.3	10.0
	6	5.2	7.7	10.7
12-gauge, $3^1/_2$-inch, $1^9/_{16}$-ounce				
20-gauge, 3-inch, 1-ounce				
1335/1330	2	4.9	7.2	9.7
	3	5.0	7.3	9.9
	4	5.1	7.4	10.1
	6	5.3	7.8	10.9
10-gauge, $3^1/_2$-inch, $1^5/_8$-ounce				
12-gauge, $2^3/_4$-inch, $1^1/_4$-ounce				
1285/1275	T	4.9	6.9	9.2
	BBB	4.9	7.0	9.3
	BB	4.9	7.1	9.5
	1	5.0	7.2	9.8
	2	5.1	7.4	9.9
	3	5.2	7.5	10.2
	4	5.2	7.6	10.4
10-gauge, $3^1/_2$-inch, $1^3/_4$-ounce				
12-gauge, 3-inch, $1^3/_8$-ounce				
1260	T	4.9	7.0	9.3
	BBB	5.0	7.1	9.4
	BB	5.0	7.1	9.6
	1	5.1	7.3	9.9
	2	5.2	7.4	10.1
	3	5.2	7.6	10.3
	4	5.3	7.7	10.6

Actual leads can vary with target speed. Lesser angles will require lesser leads.

For bags like this, the shooter might do best to stick to factory loads of steel shot, at least for the time being.

about 50 yards. All this works only if you are matching Full choke with Full choke.

It should be obvious, even if the shooter goes to a large gauge with the heaviest shot loads, that steel shot is a real handicap. So, it is vital to remember to shorten the range at which you are willing to shoot and to use the heaviest steel shot load in the longest shell and largest gauge for which you have a gun. If you can't get your hands on at least a 12-gauge 3-inch magnum, then ranges will need to be shortened drastically. If not, the reason for the switch to steel—to preserve waterfowl—will be invalid. The number of crippling losses with steel pellets among shooters who try shots at lead ranges is, in my opinion, staggering. Let's do it right and cut back on the range.

There also can be a velocity handicap with steel downrange. The heaviest steel loads have a muzzle velocity equal to a $1^1/_2$-ounce 12-gauge lead load at 1260 or, in a few cases, 1315 fps. When steel is started at the same velocity, with the same pellet size, it will lose velocity much faster due to its lower ballistic coefficient brought on by the lower density of the pellets. This is why steel shot leads may need to be modified from those you have used with lead. Table V suggests leads for steel shot. Naturally, if a bird is traveling extra fast or very slowly, then the leads will need to be increased or decreased. The table is based on average waterfowl speed and popular steel shot loads.

As mentioned earlier, steel shot reloads frequently can't match factory load velocity, and sometimes not even the shot charge weight can be duplicated. Therefore, effective ranges for steel reloads will be further reduced over those discussed for factory ammunition. Yes, the steel shotshell reloader works under many constraints.

Sources Of Steel Shot/Wads/Data

Those who wish to load steel shot should get a copy of "How To Load Steel Shotshells," Third Edition, Bulletin #8617-3, published by MEC. It is free and can be had by writing Mayville Engineering Co. This manual contains over 175 loads for 10-gauge $3^1/_2$-inch, 12-gauge $3^1/_2$-inch, 12-gauge 3-inch and 12-gauge $2^3/_4$-inch shells.

Another source of data and information is the *Steel Shot Reloading Handbook*. It contains 25 pages of how and why, with data for 35 loads. It's available from Reloading Specialties.

Caution: *The publisher and author believe that steel shot reloading technology is still in its infancy and there are many "gray areas" with respect to field performance. Therefore, we take no position on the safety or effectiveness of any steel shot data or information on the assembly of steel shot ammunition. When and if steel shot reloading becomes more practical, we will consider including steel shot data in future editions.*

MANUFACTURERS' DIRECTORY FOR SHOTSHELL RELOADING

AMMUNITION, COMMERCIAL

ACTIV Industries, Inc., 1000 Zigor Rd., P.O. Box 339, Kearneysville, WV 25430/304-725-0451; FAX: 304-725-2080
Brenneke KG, Wilhelm, Ilmenauweg 2, P.O. Box 16 46, D-3012 Langenhagen, GERMANY/511-772288
Cubic Shot Shell Co., Inc., 98 Fatima Dr., Campbell, OH 44405/216-755-0349; FAX: 216-755-0349
Dynamit Nobel-RWS, Inc., 81 Ruckman Rd., Closter, NJ 07624/201-767-1995; FAX: 201-767-1589
Federal Cartridge Co., 900 Ehlen Dr., Anoka, MN 55303/612-422-2840
Fiocchi of America, Inc., Rt. 2, P.O. Box 90-8, Ozark, MO 65721/417-725-4118; FAX: 417-725-1039
Old Western Scrounger, Inc., The, 12924 Hwy. A-I2, Montague, CA 96064/916-459-5445
Remington Arms Co., Inc., 1007 Market St., Wilmington, DE 19898/302-773-5291
RWS (See U.S. importer—Dynamit Nobel-RWS, Inc.)
Winchester Div., Olin Corp., 427 N. Shamrock, E. Alton, IL 62024/618-258-3566; FAX: 618-258-3180
Wosenitz VHP, Inc., Box 741, Dania, FL 33004/305-923-3748; FAX: 305-925-2217

AMMUNITION COMPONENTS, CASES, POWDERS & PRIMERS

Accurate Arms Co., Inc., Rt. 1, Box 167, McEwen, TN 37101/615-729-4207; FAX 615-729-4217
ACTIV Industries, Inc., 1000 Zigor Rd., P.O. Box 339, Kearneysville, WV 25430/304-725-0451; FAX: 304-725-2080
American Products Co., 14729 Spring Valley Road, Morison, IL 61270/815-772-3336; FAX: 815-772-7921
B-West Imports, Inc., 5132 E. Pima St., Tucson, AZ 85712/602-881-3525; FAX: 602-322-5704
Ballistic Products, Inc., 20015 75th Ave. North, Corcoran, MN 55340/612-494-9237; FAX: 612-494-9236
Bismuth Cartridge Co., 3500 Maple Ave., Suite 1650, Dallas, TX 75129/800-759-3333; 214-521-5882
Brenneke KG, Wilhelm, Ilmenauweg 2, P.O. Box 16 46, D-3012 Langenhagen, GERMANY/511-772288
C&D Special Products (Claybuster), 309 Sequoya Dr., Hopkinsville, KY 42240/800-922-6287, 800-284-1746
CCI, Div. of Blount, Inc., 2299 Snake River Ave., P.O. Box 856, Lewiston, ID 83501/800-627-3640, 208-746-23511
Federal Cartridge Co., 900 Ehlen Dr., Anoka, MN 55303/612-422-2840
Fiocchi of America, Inc., Rt. 2, P.O. Box 90-8, Ozark, MO 65721/417-725-4118; FAX: 417-725-1039
Hercules, Inc., Hercules Plaza, 1313 N Market St., Wilmington, DE 19894/302-594-5000
Hodgdon Powder Co., Inc., P.O. Box 2932, Shawnee Mission, KS 66201/913-362-9455; FAX: 913-362-1307
Hornady Mfg. Co., P.O. Box 1848, Grand Island, NE 68801/800-338-3220, 308-382-1390
IMR Powder Co., Box 247E, Xplo Complex, RTS, Plattsburgh, NY 12901/518-561-9530; FAX: 518-563-0044
Lage Uniwad, Inc., P.O. Box 446, Victor, IA 52327/319-647-3232
Lawrence Brand Shot (See Precision Reloading, Inc.)
MEC, Inc., 715 South St., Mayville, WI 53050/414-387-4500
Murmur Corp., 2823 N. Westmoreland Ave., Dallas, TX 75222/214-630-5400
Norma (See U.S. importer—Paul Co., The)
Old Western Scrounger, Inc., The, 12924 Hwy. A-I2, Montague, CA 96064/916-459-5445
Pattern Control, 114 N. Third St., Garland, TX 75040/214-494-3551
Paul Co., The, Rt. 1, Box 177A, Wellsville, KS 66092/913-883-4444
Polywad, Inc., P.O. Box 7916, Macon, GA 31209/912-477-0669
Precision Reloading, Inc., P.O. Box 122, Stafford Springs, CT 06076/203-684-7979; FAX: 203-684-6788
Reloading Specialties, Inc., 209 S.W. 2nd Ave. Box 1130, Pine Island, MN 55963/507-356-8500
Remington Arms Co., Inc., 1007 Market St., Wilmington, DE 19898/302-773-5291
Scot Powder Co., 1200 Talley Road, Wilmington, DE 19809/302-764-9779
Steel Reloading Components, Inc., P.O. Box 812, Washington, IN 47501/812-254-3775; FAX: 812-254-7269
Trico Plastics, 590 S. Vincent Ave., Azusa, CA 91702
Vihtavuori Oy/Kaltron-Pettibone, 1241 Ellis St., Bensenville, IL 60106/708-350-1116; FAX: 708-350-1606
Vitt/Boos, 2178 Nichols Ave., Stratford, CT 06497/203-375-6859
Winchester Div., Olin Corp., 427 N. Shamrock, E. Alton, IL 62024/618-258-3566; FAX: 618-258-3180
Windjammer Tournament Wads, Inc., 750 W. Hampden Ave. Suite 170, Englewood, CO 80110/303-781-6329
Wosenitz VHP, Inc., Box 741, Dania, FL 33004/305-923-3748; FAX: 305-925-2217

CHRONOGRAPHS & PRESSURE TOOLS

Canons Delcour, Rue J.B. Cools, B-4040 Herstal, BELGIUM/+32.(0)41.40.13.40; FAX: +32(0)412.40.22.88
Chronotech, 1655 Siamet Rd. Unit 6, Mississauga, Ont. L4W 1Z4 CANADA/416-625-5200; FAX: 416-625-5190
Competition Electronics, Inc., 3469 Precision Dr., Rockford, IL 61109/815-874-8001; FAX: 815-874-8181
Custom Chronograph, Inc., 5305 Reese Hill Rd., Sumas, WA 98295/206-988-7801
D&H Precision Tooling, 7522 Barnard Mill Rd., Ringwood, IL 60072/815-653-4011
Dedicated Systems, 105-B Cochrane Circle, Morgan Hill, CA 95037/408-779-2808; FAX: 408-779-2673
Lachaussee, S.A., 29 Rue Kerstenne, Ans, B-4430 BELGIUM/041-63 88 77
Oehler Research, Inc., P.O. Box 9135, Austin, TX 78766/512-327-6900
P.A.C.T., Inc., P.O. Box 531525, Grand Prairie, TX 75053/214-641-0049
Shooting Chrony, Inc., P.O. Box 101 LP, Niagara Falls, NY 14304/416-276-6292; FAX: 416-276-6295
Stratco, Inc., 200 E. Center St., Kalispell, MT 59901/406-755-4034; FAX: 406-257-4753
Tepeco, P.O. Box 342, Friendswood, TX 77546/713-482-2702

RELOADING TOOLS & ACCESSORIES

Ballistic Products, Inc., 20015 75th Ave. North, Corcoran, MN 55340/612-494-9237; FAX: 612-494-9236
Hollywood Engineering, 10642 Arminta St., Sun Valley, CA 91352/818-842-8376
Hornady Mfg. Co., P.O. Box 1848, Grand Island, NE 68801/800-338-3220, 308-382-1390
Lee Precision, Inc., 4275 Hwy. U, Hartford, WI 53027/414-673-3075
MEC, Inc., 715 South St., Mayville, WI 53050/414-387-4500
Multi-Scale Charge Ltd., P.O. Box 101 LP, Niagara Falls, NY 14303/416-566-1255; FAX: 416-276-6295
Multipax, Inc., 8086 S. Yale, Suite 286, Tulsa, OK 74136/918-496-1999; FAX: 918-492-7465
Pattern Control, 114 N. Third St., Garland, TX 75040/214-494-3551
Ponsness/Warren, P.O. Box 8, Rathdrum, ID 83858/208-687-2231; FAX: 208-687-2233
Precision Reloading, Inc., P.O. Box 122, Stafford Springs, CT 06076/203-684-7979; FAX: 203-684-6788
RCBS, Div. of Blount, Inc., 605 Oro Dam Blvd., Oroville, CA 95965/800-533-5000, 916-533-5191

GAUGES, CALIPERS & MICROMETERS

Blue Ridge Machinery and Tools, Inc., P.O. Box 536-GD, Hurricane, WV 25526/304-562-3538; FAX: 304-562-5311
C-H Tool & Die Corp./4-D Custom Die Co., 711 N. Sandusky St., P.O. Box 889, Mt. Vernon, OH 43050-0889/614-397-7214; FAX: 614-397-6600
CP Specialties, 1814 Mearns Rd., Warminster, PA 18974
Dillon Precision Products, Inc., 7442 E. Butherus Dr., Scottsdale, AZ 85260/602-948-8009
Forgreens Tool Mfg., Inc., P.O. Box 990, Robert Lee, TX 76945/915-453-2800
Forster Products, 82 E. Lanark Ave., Lanark, IL 61046/815-493-6360; FAX: 815-493-2371

Hornady Mfg. Co., P.O. Box 1848, Grand Island, NE 68801/800-338-3220, 308-382-1390
K&M Services, P.O. Box 363, 2525 Primrose Lane, York, PA 17404/717-764-1461
Lyman Products Corp., Rt. 147 West St., Middlefield, CT 06455/203-349-3421; FAX: 203-349-3586
MEC, Inc., 715 South St., Mayville, WI 53050/414-387-4500
Midway Arms, Inc., P.O. Box 1483, Columbia, MO 65205/314-445-6363; FAX: 314-446-1018
Precision Reloading, Inc., P.O. Box 122, Stafford Springs, CT 06076/203-684-7979; FAX: 203-684-6788
RCBS, Div. of Blount, Inc., 605 Oro Dam Blvd., Oroville, CA 95965/800-533-5000, 916-533-5191
Sinclair International, Inc., 2330 Wayne Haven St., Fort Wayne, IN 46803/219-493-1858; FAX: 219-493-2530

LABELS, BOXES & SHOTSHELL HOLDERS

Anderson Manufacturing Co., Inc., P.O. Box 2640, 2741 N. Crosby Rd., Oak Harbor, WA 98277/206-675-7300; FAX: 206-675-3939
Arkfeld Mfg. & Dist. Co., Inc., P.O. Box 54, Norfolk, NE 68702-0054/402-371-9430; 800-533-0676
Ballistic Products, Inc., 20015 75th Ave. North, Corcoran, MN 55340/612-494-9237; FAX: 612-494-9236
Cabinet Mtn. Outfitter, P.O. Box 766, Plains, MT 59859/406-826-3970
Del Rey Products, P.O. Box 91561, Los Angeles, CA 90009/213-823-0494
Flambeau Products Corp., P.O. Box 97, Middlefield, OH 44062/216-632-1631; FAX: 216-632-1581
Hornady Mfg. Co., P.O. Box 1848, Grand Island, NE 68801/800-338-3220, 308-382-1390
J&J Products Co., 9240 Whitmore, El Monte, CA 91731/818-571-5228; FAX: 818-571-8704
KLP, Inc., 215 Charles Dr., Holland, MI 49424/616-396-2575; FAX: 616-396-1287
Kolpin Mfg., Inc., P.O. Box 107, 205 Depot St., Fox Lake, WI 53933/414-928-3118; FAX: 414-928-3687
Lakewood Products, Inc., P.O. Box 1527, 1445 Eagle St., Rhinelander, WI 54501/715-369-3445
Lyman Products Corp., Rt. 147 West St., Middlefield, CT 06455/203-349-3421; FAX: 203-349-3586
MTM Moulded Products Co., Inc., 3370 Obco Ct., Dayton, OH 45414/513-890-7461; FAX: 513-890-1747
Midway Arms, Inc., P.O. Box 1483, Columbia, MO 65205/314-445-6363; FAX: 314-446-1018
Pattern Control, 114 N. Third St., Garland, TX 75040/214-494-3551
Peterson Instant Targets, Inc. (See Lyman Products Corp.)
RCBS, Div. of Blount, Inc., 605 Oro Dam Blvd., Oroville, CA 95965/800-533-5000, 916-533-5191
Ravell Ltd., 289 Diputacion St., 08009, Barcelona SPAIN
Stalwart Corp., P.O. Box 357, Pocatello, ID 83204/208-232-7899

LOADING BLOCKS

Ballistic Products, Inc., 20015 75th Ave. North, Corcoran, MN 55340/612-494-9237; FAX: 612-494-9236
Flambeau Products Corp., P.O. Box 97, Middlefield, OH 44062/216-632-1631; FAX: 216-632-1581
Hornady Mfg. Co., P.O. Box 1848, Grand Island, NE 68801/800-338-3220, 308-382-1390
Lyman Products Corp., Rt. 147 West St., Middlefield, CT 06455/203-349-3421; FAX: 203-349-3586
MEC, Inc., 715 South St., Mayville, WI 53050/414-387-4500
Midway Arms, Inc., P.O. Box 1483, Columbia, MO 65205/314-445-6363; FAX: 314-446-1018
MTM Moulded Products Co., Inc., 3370 Obco Ct., Dayton, OH 45414/513-890-7461; FAX: 513-890-1747
RCBS, Div. of Blount, Inc., 605 Oro Dam Blvd., Oroville, CA 95965/800-533-5000, 916-533-5191
Redding Reloading Equipment, 1089 Starr Rd., Cortland, NY 13045/607-753-3331; FAX: 607-756-8445
Stalwart Corp., P.O. Box 357, Pocatello, ID 83204/208-232-7899
Trico Plastics, 590 S. Vincent Ave., Azusa, CA 91702

POWDER MEASURES, SCALES, FUNNELS & ACCESSORIES

ASI, 6226 Santos Dias St., Irwindale, CA 91706/818-334-6629
C-H Tool & Die Corp./4-D Custom Die Co., 711 N. Sandusky St., P.O. Box 889, Mt. Vernon, OH 43050-0889/614-397-7214; FAX: 614-397-6600
Dedicated Systems, 105-B Cochrane Circle, Morgan Hill, CA 95037/408-779-2808; FAX: 408-779-2673
Denver Instrument Co., 6542 Fig St., Arvada, CO 80004/800-321-1135, 303-431-7255
Dillon Precision Products, Inc., 7442 E. Butherus Dr., Scottsdale, AZ 85260/602-948-8009
Forster Products, 82 E. Lanark Ave., Lanark, IL 61046/815-493-6360; FAX: 815-493-2371
Hollywood Engineering, 10642 Arminta St., Sun Valley, CA 91352/818-842-8376
Hornady Mfg. Co., P.O. Box 1848, Grand Island, NE 68801/800-338-3220, 308-382-1390
Lee Precision, Inc., 4275 Hwy. U, Hartford, WI 53027/414-673-3075
Lyman Products Corp., Rt. 147 West St., Middlefield, CT 06455/203-349-3421; FAX: 203-349-3586
MTM Moulded Products Co., Inc., 3370 Obco Ct., Dayton, OH 45414/513-890-7461; FAX: 513-890-1747
Old Western Scrounger, Inc., The, 12924 Hwy. A-l2, Montague, CA 96064/916-459-5445
Precision Reloading, Inc., P.O. Box 122, Stafford Springs, CT 06076/203-684-7979; FAX: 203-684-6788
Quinetics Corp., P.O. Box 13237, San Antonio, TX 78213/512-684-8561; FAX: 512-684-2912
RCBS, Div. of Blount, Inc., 605 Oro Dam Blvd., Oroville, CA 95965/800-533-5000, 916-533-5191
Redding Reloading Equipment, 1089 Starr Rd., Cortland, NY 13045/607-753-3331; FAX: 607-756-8445
Sinclair International Inc., 2330 Wayne Haven St., Fort Wayne, IN 46803/219-493-1858; FAX: 219-493-2530
VibraShine, Inc., Rt. 1, P.O. Box 64, Mt. Olive, MS 39119/601-733-5614; FAX: 601-733-2226

SHOTSHELL MISCELLANY

Ballistic Products, Inc., 20015 75th Ave. North, Corcoran, MN 55340/612-494-9237; FAX: 612-494-9236
Hornady Mfg. Co., P.O. Box 1848, Grand Island, NE 68801/800-338-3220, 308-382-1390
Precision Reloading, Inc., P.O. Box 122, Stafford Springs, CT 06076/203-684-7979; FAX: 203-684-6788

TARGETS

Clay Target Enterprises, 300 Railway Ave., Campbell, CA 95008/408-379-4829
Federal Champion Target Co., 232 Industrial Parkway, Richmond, IN 47374/800-441-4971; FAX: 317-966-7747
Hornady Mfg. Co., P.O. Box 1848, Grand Island, NE 68801/800-338-3220, 308-382-1390
Remington Arms Co., Inc., 1007 Market St., Wilmington, DE 19898/302-773-5291
River Road Sporting Clays, Bruce Barsotti, P.O. Box 3016, Gonzales, CA 93926/408-675-2473
Shotgun Shop, The, 14145 Proctor Ave., Suite 3, Industry, CA 91746/818-855-2737; FAX: 818-855-2735
White Flyer, 124 River Rd., Middlesex, NJ 08846/908-469-0100; FAX: 908-469-9692

RELOADING FOR SHOTGUNNERS

ALL NEW AND EXPANDED 3RD EDITION

- OVER 2,000 LOADS ORGANIZED BY RECOMMENDED APPLICATION, GAUGE, CASE TYPE AND SHOT CHARGE

- The complete how and why of shotshell reloading for hunters, and competitive shooters.

ISBN 0-87349-151-3

0 46081 00151 2

By Edward A. Matunas