A LOOK AT RECOIL

BY LARRY NAILON

The recoil produced by a shotgun is in direct relationship to the weight of the shot projectile and the muzzle velocity. Newton's law of motion applies to shotguns just like everything else. For each action there is always an equal and opposite reaction. The harder you push against the shot projectile, the more the recoil. This constant never changes. It takes more force to push a heavy shot charge to a certain muzzle velocity than it does a light shot charge, and the recoil is more from the equal and opposite reaction. Felt recoil is how and when the shooter receives actual recoil through the shotgun.

What complicates shotgun recoil is that felt recoil is completely different to actual recoil, but felt recoil comes directly from the force of actual recoil. Felt recoil is directly affected by a host of factors that include gun weight, gun fit, internal barrel configurations and the physical stature of the shooter – just to name a few. As a shell is fired, the movement of the gun determines a big part of felt recoil. A large heavy shooter moves quite differently to a slender built shooter – changing felt recoil with the same gun/load combination. Add to this a portion of the shooter's arm weight which must be added to the total gun weight and the list of variables is almost endless.

The common perception that one-ounce loads kick less than loads of 1⅛ can be very misleading. Just a 10 per cent increase in muzzle velocity can make the one ounce load produce an equal amount of actual recoil as a 1⅛ oz load. In addition, most manufacturers choose to increase the velocity of one ounce loads by using fast burning powders that produce high chamber pressures, equal or higher than the same manufacturers 1⅛ oz load. The pressure from the burning powder pushes in all directions with an equal force. The harder you push on the wad/shot projectile the harder it pushes rearward generating recoil. Again, the laws of motion apply to shotguns. The only way to reduce recoil with the one ounce load is to maintain a muzzle velocity equal to a heavier load. With the same powder, a one ounce load will produce a lower chamber pressure than it does with a load of 1⅛ ounce considering equal muzzle velocities. To take the recoil reduction of the one ounce load another step, loads can be developed using moderate burn rate powders that produce low chamber pressures – around 7,000 psi – and shoot consistent muzzle velocities. This type of load actually increases load performance because it reduces the degree of shot deformation during barrel travel. Normal factory loads of one ounce and 1⅛ ounce produce chamber pressures around the 10,000 psi range. A 30 per cent lower chamber pressure does not reduce shot deformation but it reduces deformation a measurable amount while lowering the sharpness of felt recoil. Factory shells from the same box can produce variations of 2,000 psi chamber pressures. Small variations in shell components and loading produce these pressure variations. This directly relates to a variation of actual recoil. With felt recoil, changes are not always in direct relation to the peak chamber pressure because of the variables associated with felt recoil. Like all other parts of shotgun ballistics, you deal with an average.

Gas operated semi-auto loading shotguns present yet another different type of felt recoil. First and foremost they do not change the total of recoil – that is established by the shot charge weight and muzzle velocity achieved. They simply change how and when the shooter receives the total of recoil. They reduce the sharpness of recoil by spreading the peak force of recoil over an extended period of time as the action of the semi-auto pushes against the springs of the operating system. Therefore, the strength of the action springs combined with the friction of bolt movement directly affects felt recoil. In theory, you want the strongest spring possible in semi-autos that allows the action to function properly. This spreads the recoil

over the longest period of time reducing the peak force of felt recoil. The springs of semi-auto loading shotguns lose some of their strength after firing 3,000 to 5,000 rounds. In one spring test after the firing of 5,000 shells, the action spring had lost 20 per cent of its initial strength. The main action springs of semi-automatics should be changed on a regular basis to achieve the best reduction of felt recoil.

Recoil operated semi-automatic shotguns present a different type of recoil than gas operated shotguns. As the barrel moves rearward to a stopping point for the action to function properly, the shooter receives a second bump of recoil. In effect, these recoil-operated semi-automatics produce two separate peaks of recoil – one from the force of projectile acceleration and one from the barrel movement when it stops against the receiver. This normally feels like more recoil, dependent upon the force of actual recoil and the physical stature of the shooter. As a general rule, recoil operated guns feel like they kick more than gas operated shotguns. It's hard enough for a target shooter to stand one peak of recoil, let alone two bumps of recoil with every shot. Some gun manufacturers advertise that their guns will shoot all different types of shot shell. What they don't tell you is how strong the recoil is. It ranges from strong to more than necessary – if you can keep your hat on!

Another variable in felt recoil is how the shooter's body tenses in anticipation of recoil. Just before a shot is fired, the body tightens up to receive the recoil in a form of isometrics. The muscle tightening tension varies for each shooter. The tiredness, or shoot fatigue, that you feel after shooting a long series of shots is a reflection of this tension. It changes from day to day – affected by the number of shots and the strength of the recoil received. Everything seems to affect this variable factor of recoil. How you grip the gun during firing and whether that grip is the same every time is one example. To demonstrate how this affects recoil, fire your gun holding it softly. Then, with a golf glove on your extended hand, grip the gun tightly and fire the same shells. You will feel a good reduction of recoil when the gun is held tight. Also, do you grip the gun the same on a crossing shot as you do a straight away shot? This adds more of the weight of your arm to the total gun weight during recoil and reduced initial gun movement.

A heavy gun reduces the early sharpness of felt recoil. The trade-off is that the shooter must absorb longer recoil due to the kinetic energy imparted into the gun by the force of actual recoil. Kinetic energy recoil (gun movement) lasts until the shooter starts forward movement after absorbing the total force of recoil. Everything you can name about firing a shotgun affects recoil and how that recoil feels. To the shooters that say 'recoil doesn't bother me', just wait a few years and answer that question again. Recoil is a 'Real Devil' in target shooting. ■

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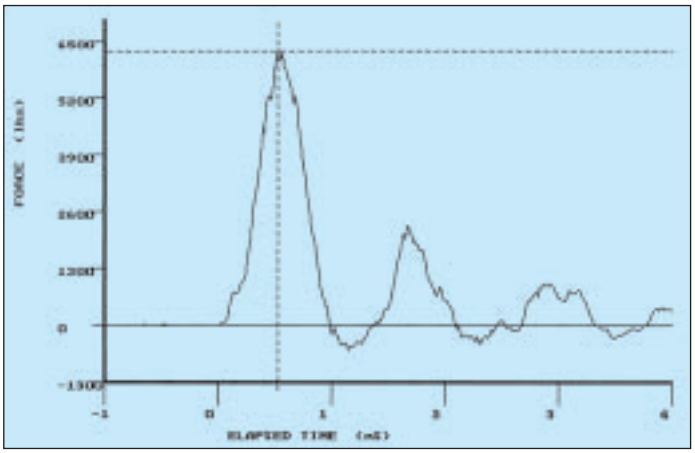
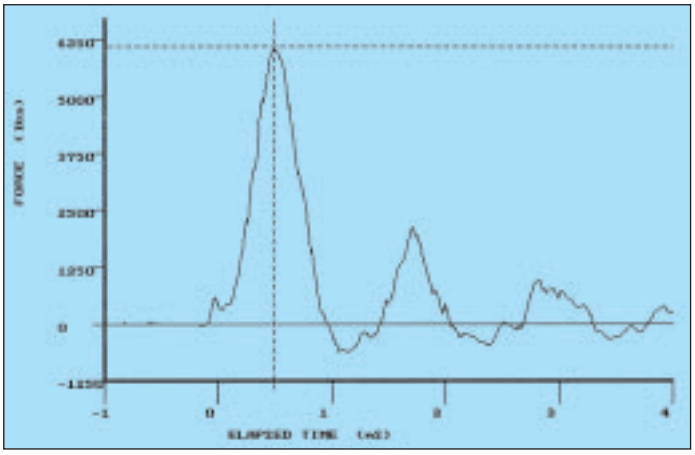
THESE RECOIL DISPLAYS SHOW THE FORCE OF ACTUAL RECOIL IN A TIME FRAME OF MILLI-SECONDS, WITH A SOLID MOUNTED GUN. A 1200 FPS LOAD TAKES 2¼ MILLI-SECONDS TO EXIT THE MUZZLE. THE BALANCE OF THE DISPLAYS AFTER MUZZLE EXIT IS THE FLEX AND UNLOADING OF THE MEASUREMENT EQUIPMENT AND SHOULD BE DISREGARDED IN RECOIL COMPARISONS. HOW FAST THE RISE IS TO THE PEAK FORCE OF RECOIL RELATES TO THE SHARPNESS OF FELT RECOIL.

RECOIL DISPLAY #1 1220 fps - 1⅛oz Sporting Clay Load



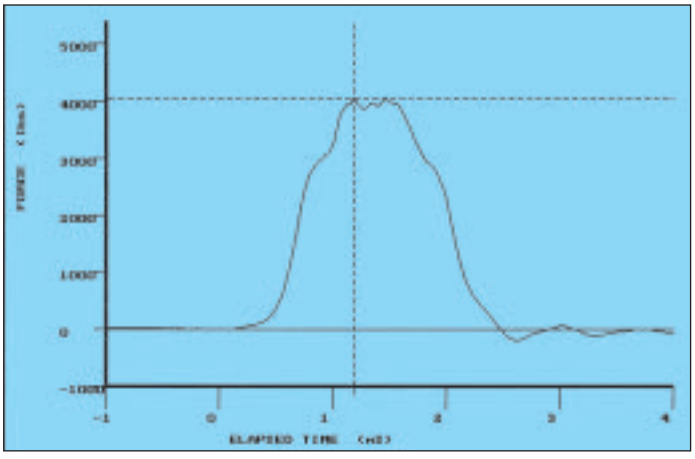
Peak Recoil: 6266 lbs at 0.530 milliseconds. Shot No. 9. Avg Recoil: 2877 lbs in 0.980 milliseconds.
Load: FACTORY Load Temp: 75 degrees F

RECOIL DISPLAY #2 1293 fps - 1 oz Sporting Clay Load



Peak Recoil: 6123 lbs at 0.490 milliseconds. Shot No. 7 Avg Recoil: 2866 lbs in 0.950 milliseconds.
Load: FACTORY Load Temp: 75 degrees F

RECOIL DISPLAY #3 Gas operated Semi-Auto 1293 fps - 1 oz Sporting Clay Load



Peak Recoil: 4040 lbs at 1.180 milliseconds. Shot No. 21 Avg Recoil: 1687 lbs in 1.270 milliseconds.
Load: FACTORY Load Temp: 72 degrees F