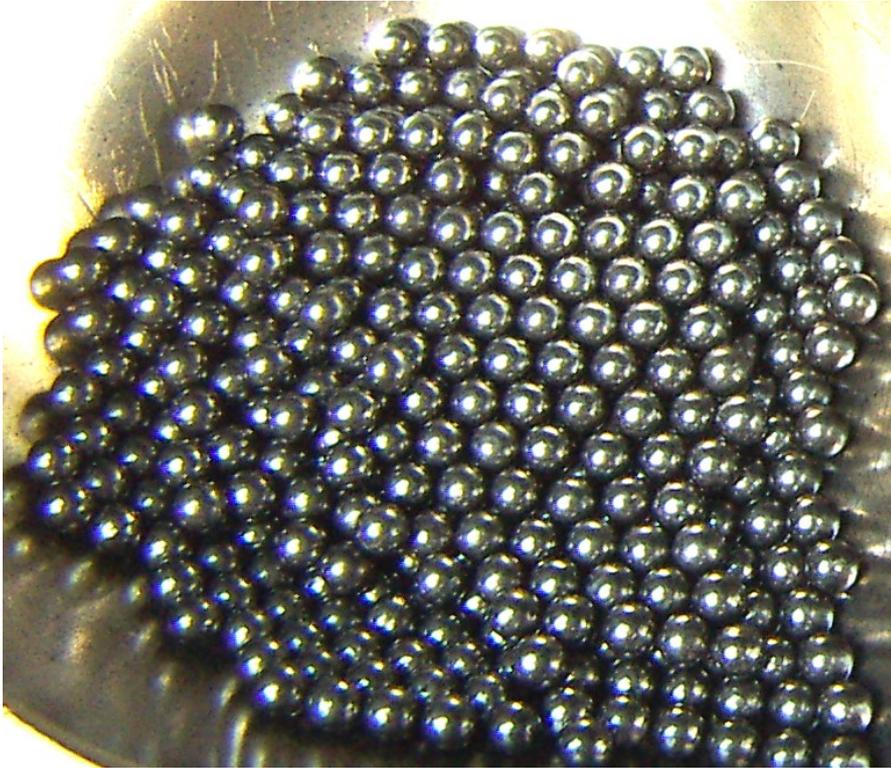


Steel: what sizes are really needed?



Here we are continuing our quest to establish for parity of performance with steel shot pellets for larger game birds such as pheasants.

This now involves investigating just how large the steel pellets would have to be to match up with our old friends Lead UK numbers five and four.

As ever, modern up to date ballistic data from the USA has been used to compile the charts and is solely an attempt to tell the truth regarding the limitations or otherwise of steel shot pellets for game shooting. Last time this was with the currently allowed steel pellets, this time we investigate the potential of larger sizes not currently permitted in lead shot proofed shotguns.

The old 1¼ oz (35.5gm) UK numbers 4 and 5 lead shot loads were very popular for duck shooting, with the latter being still a favourite for pheasants, with years of cumulative experience proving that they were very effective pellet sizes for the reliable harvesting of the bag.

If there is a general lead shot ban for game shooting, the cheaper option of Steel pellets would have to be considered. There has been much confusion regarding the steel pellet sizes that would effectively match their performance.

To briefly recap last time we looked at the established perceived wisdom's original premise that going two sizes larger with steel pellets would do the job, and although on paper the pellet energy levels looked

convincing, it was in the serious business of adequate penetration — the ability to reach and disable the vital organs, that unfortunately things went wrong.

We found that the steel pellets of the same weight, by necessity, were considerably larger than those of lead. The lower density of the soft iron pellets is the reason for the need to increase the pellet diameter.

What this does is give us an identical number of pellets in each type of load, which initially sounds like a good idea. However, the resistance of the air to the flight of the pellets will slow down the steel ones much more quickly. One way to partially improve on things here is to launch the steel pellets at a higher velocity, this works in a way, but only up to a point. It is not enough to give the ranging power or retained velocity of the same weight lead pellet.

It must be appreciated that some of the lead pellets within the load do deform, and as such will not retain as much downrange energy or penetration, becoming fliers on the fringes of the pattern, but the pellets remaining in good condition, which tend to be more towards the pattern centre will represent the performances listed here.

Harder lead pellets with a greater percentage of added antimony hardening agents, will resist this deformation to a much greater degree, these are known as Magnum lead pellets in the USA.

However by the same token their overall density will be slightly lower than their softer lead counterparts, reducing their ranging power a little.

Steel pellets do not usually deform due to their hardness, but there will be a large percentage of total numbers missing in any comparable weight of a lead shot loading, which does tend to offset this apparent advantage.

The other issue is that in the UK we are bound by C.I.P. rules that restrict the maximum velocity and momentum of a load of steel shot. The performance of steel loads as produced in the USA, are not

covered by these rules, so in some cases are loaded to extremely high velocities of 1700 feet per second or more.

The fastest steel UK loads for lead shot proofed guns are technically allowed about 1400 feet per second equivalent at the muzzle, but in reality, after testing many types, this is at best no more than 1300 feet per second.



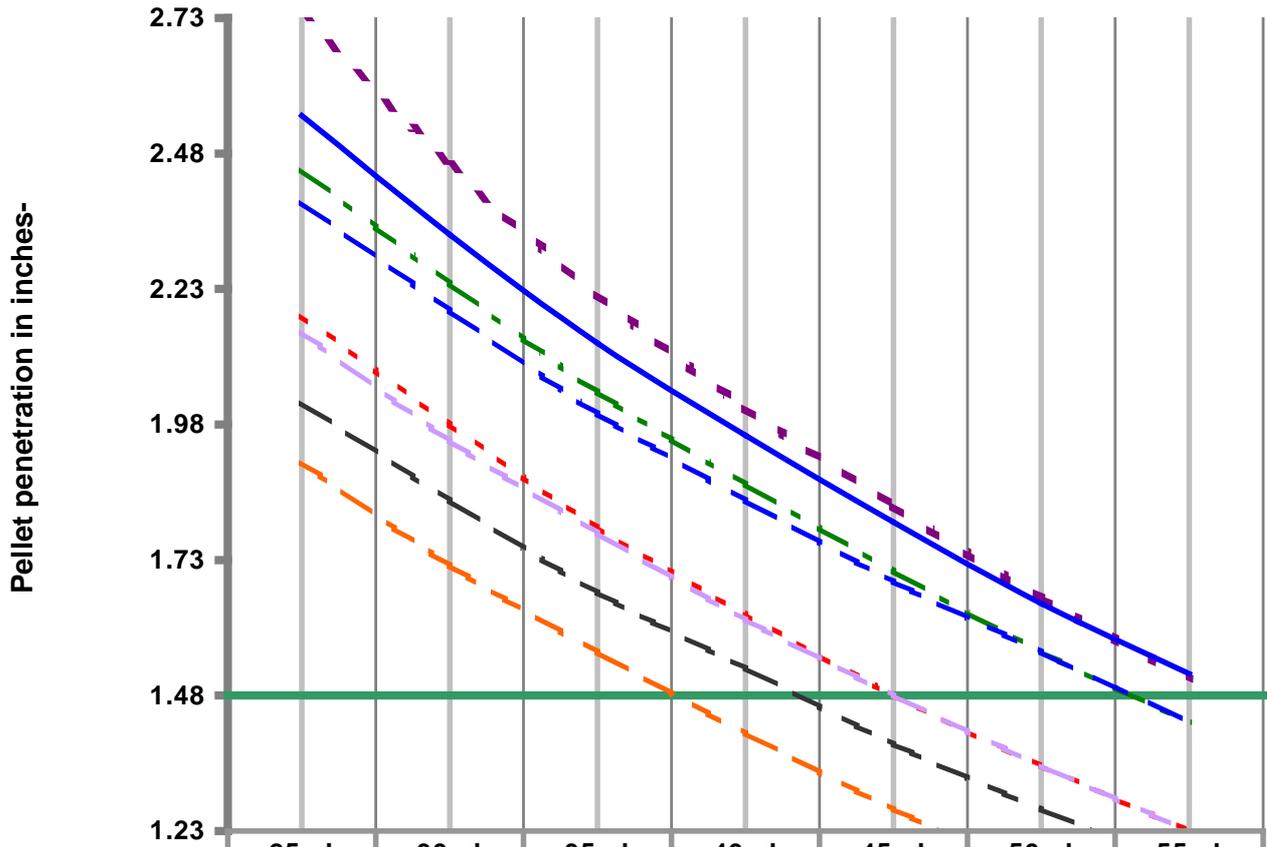
On this basis any recommendations quoted in the USA for comparable lead and steel pellets for use in the field cannot be translated into equivalent advice for use with UK C.I.P. compliant loadings. With an extra 400 plus feet per second velocity the case for the steel FE2 pellet (the old UK B size equivalent) is transformed from being the downrange penetrative equivalent to a high velocity UK number 5 lead pellet, to matching up with a high velocity UK number 4 lead pellet.

The reality is that these ultra high-speed loads are simply not allowed under the C.I.P. rules for steel shot, even in steel shot proofed magnums. There is the distinct possibility that even if the rules were relaxed regarding the maximum pellet sizes for non-steel shot guns, it is almost certain that the currently allowed maximum velocities would be further restricted, as well as choke constriction limits.

What is needed is a further increase in both the weight and steel pellet size to overcome the savage air resistance forces downrange. Happily, the steel pellet size that is able to do this will also possess sufficient penetration for the intended quarry. The actual amount of striking energy will be greater than the smaller lead pellet, but the penetration will be of the same order.

We can see from the pellet penetration graph that Steel FE 2 pellets could be a replacement for a high velocity load of UK size number 5 (2.8mm) lead shot when the current typical UK velocities are used for non-steel shot proofed guns.

Steel pellet penetration comparison with UK lead numbers 4 & 5 shot



	25yd	30yd	35yd	40yd	45yd	50yd	55yd
Steel FE2 1700fps	2.74	2.46	2.22	2.01	1.83	1.66	1.51
Lead UK4 H/V	2.55	2.33	2.13	1.96	1.8	1.65	1.52
Steel FE1(UKBB)	2.45	2.24	2.04	1.87	1.71	1.56	1.43
Lead UK4	2.39	2.19	2	1.84	1.69	1.56	1.43
Steel FE2(UKB)	2.18	1.98	1.79	1.63	1.48	1.35	1.23
Lead UK5 H/V	2.15	1.95	1.78	1.62	1.48	1.35	1.23
Lead UK5	2.02	1.84	1.67	1.53	1.39	1.27	1.16
Steel FE3(UK1)	1.91	1.72	1.56	1.41	1.27	1.15	1.03

Range in yards and pellet penetration in inches

The main issues though would be the lack of pellets in the load, as it is most unlikely that a full 32grams of such large pellets could be squeezed in a standard type of cartridge case as the plastic wad would have to be thicker than used at present in the steel UK 3 loadings.

Pellet count and ranging power issues.

Firstly, none of the larger than FE4 (UK3) sized listed steel pellets can be used in non-steel shot proofed guns. The steel UK number 3 equivalent is the largest currently loaded in the so-called steel shot 'game' loadings.

Steel FE3 0.14inches diameter (3.56mm) with 153 pellets per ounce; this is very close to UK1.

Even though it is about four pellet sizes larger than the lead number 5's, it cannot match their downrange penetration, being 5 yards behind.

Steel FE3 penetrates 1.27inches at 45yards, but the lead number 5 manages the same 1.27inches at 50yards.

This is because the lower density of the steel pellets causes the velocity and thus penetration values to drop off more rapidly as the range is extended.

What this shows as we discovered last time and is again shown in this chart for clarity is that at 40yards, four pellet sizes were needed to practically achieve suitable levels of matching penetration.

When the range is increased to 50yards, a further increase in pellet size is required to five times larger, with the current velocities.

FE2 (UK B) = 124 pellets per ounce: The penetration equivalent from 45 through to 55 yards is the High Velocity UK lead number 5(2.8mm), with 220 pellets per ounce. The standard game velocity lead number 5 pellet has about 3 yards less ranging power than either.

Pattern density problem: there are 96 more pellets per ounce in the lead 5 loading (Plus 77.5%).

Even with the undeniable wastage of a percentage of deformed lead pellets in the pattern, the steel loading is at a tremendous disadvantage with regard to its pattern density potential.

FE1 (UKBB) = 102 pellets per ounce.

Here we have virtual parity of penetration with Lead number 4's, but with 170 pellets to the ounce the Lead pellets have a considerable numerical advantage, with almost 69% more of them in an equivalent loading. Due to their larger diameter these bigger steel pellets will not 'stack' as neatly in the plastic wads as will the smaller sizes, with the larger air gaps also reducing what can be squeezed into the plastic wad in safety.

The pattern conundrum

If these larger pellets were allowed in a 70mm cased cartridge for use in lead shot proofed guns, then it is extremely unlikely that 32grams of shot could possibly be contained therein.

The harsh reality might be that only around 28grams would fit, which although bringing with it a welcome reduction in recoil, it would limit the available pellet numbers in the pattern still further.

This could be problematic as the established ideals suggest that we need a minimum pattern of about 120 pellets in the 30inch circle for pheasant shooting. The steel UK BB equivalent load would have only 102 pellets in the 28.35gram 1oz loading.

It is true that some USA sources recommend a minimum pattern of about 90 pellets in the 30inch circle with steel loads for pheasants, but even in this case a very tight control is going to have to be exercised over the pattern spread to obtain this.

Even the FE2 steel loading would only just scrape home with 124 pellets in a 28.35gram 1oz load within the UK guidelines. This would mean however that a virtual 100% pattern would be required, which would be the first thing to fail, consequently limiting the effective range, rather than the penetration levels of the pellets which is what we found with the existing steel game loadings.

With the USA 90 pellet rating something rather better than a 70% pattern would be required at 50yards, rather better than an extra full choke delivery at this range.

Even with the current limiting requirements of no more than a half choke constriction (for nothing larger than the smaller FE4/UK3 3.25mm diameter pellets) when compared to lead shot for similar pattern spreads, this is going to be a very tall order indeed.

The choke restriction would almost certainly have to be made much more open than half, due to very real possibility of bulging at the cones and chokes as well as other barrel damage with the use of larger than 3.25mm steel pellets in lead shot proofed guns; the current C.I.P. steel shot rules prevent such activity.

New guns needed?

For high bird shooting such as in Devon with the aforementioned USA manufactured ultra high speed steel FE2 loadings with 1700 feet per second, a steel shot proofed gun will be needed, with a 3.5inch chamber to take full advantage of these loads and keep the steel FE2 pellet count to a higher level.

Pellet count comparison: UK number 4 Lead 36gm load = 216 pellets (2 ³/₄ inch /70mm chamber), diameter 3.1mm

US FE Number 2 Steel 39gm load = 171 pellets (3.5inch/89mm chamber), diameter 3.81mm.

Incidentally the Steel Fe number 2 pellet equates to the old UK B pellet size, slotting between the UK number 1 (3.6mm) and BB (4.1mm) pellets in diameter.

But at the moment it must be realised that these high-speed steel loads are not allowed under the C.I.P. rules, so their use cannot be condoned.

The longer 3.5inch cartridge case is needed with this 39gm load of Steel FE #2 shot because it takes up a much larger volume due to the lower pellet density when compared to lead shot.

The main downside with the heavy ultra high-speed USA loads of FE2 steel is the much higher recoil, and the need for a 3.5inch chambered gun, but a suitably constructed gas operated semi-auto of sufficient weight of 9lbs plus would help here.