



Sellier & Bellot presents cartridges for hunting with the homogeneous eXergy bullet

Homogeneous lead-free bullets are currently included in the standard range offered by the world's leading manufacturers of ammunition. Our hunters have also already obtained a certain amount of experience with them; some of this was positive, for others some of their characteristics created a certain amount of discomposure. Though their environmental benefits are respected and appreciated by everybody, there is also considerable evidence concerning the negative effects of lead and other heavy metals on the environment. When, some years ago, the Sellier & Bellot Company began to load hunting cartridges with XLC and TSX bullets from the Barnes Company, it did not intend simply to espouse a new, modern trend and thereby extend the existing range with an interesting new product. Top people in the company had swiftly realised that escalating attempts at different levels within the European Union to restrict the use of lead ammunition for sporting and hunting ammunition might already become successful in the foreseeable future. Investment and effort into the further development of such bullets that made use of lead would probably, in a relatively short time become worthless. They decided therefore to take advantage of the design, organisational and production potential of the company and to set off on their own path, seeking to enrich the field with new approaches and with unique and original solutions. And it is to the outcome of this process that we wish to introduce you.

"Prior to the commencement of the actual development of the homogeneous bullet, it was necessary to define the basic objectives that such bullet must meet," states Ing. Pavel Kratochvíl, referring back to the very beginning of the process. "An absolutely crucial decision, from which the subsequent work developed, was that we would develop a deforming bullet, with controlled deformation. One model for us was the successful design of the Soft Point bullets (SP) and the Soft Point Cutting Edge bullets (SPCE), loaded in the cartridges made by Sellier & Bellot. We focused primarily on addressing the terminal effects of the bullets and their exterior ballistics. In this we could no longer rely only on testing using substitute materials, such as ballistic gelatine or blocks of ballistic soap; instead it was necessary to utilise the experience and knowledge of renowned hunters, who would objectively assess the bullet and compare its characteristics and quality specifically with the SP and SPCE bullets. These, within our programme PRECIZE, we subjected to intensive user testing and their behaviour and effects were analysed in detail. I think that no manufacturer ever gathered such a large quantity of accurate statistical data relating to the traumatic effects of bullets as we did. Similarly, we capitalised also on the experience gained during the testing of some of the homogeneous bullets made by competing manufacturers. And these extensive tests, which mapped in detail the reliability, accuracy and traumatic effects of the bullets monitored, permitted us to formulate the requirements as to what the new bullet should look like and how should it behave."

Subsequently five basic characteristics were established to define the requirements for the new bullet:

- Reliability and Safety
- Accuracy
- Controlled deformation, while retaining a near-perfect weight balance
- The least possible difference in the traumatic effect and other behaviour, in comparison with lead bullets
- Rapid deformation of the bullet.

An intensive process began, familiar to all those who have ever been involved in the development and introduction of a new product. The study of the development and the implementation of the production of a new bullet underwent the corporate review process and the first drawings appeared on the drawing-board of the chief designer. These were based on the well-proven design of the 2937 Soft Point bullet with a weight of 11.7 grams, with which cartridges of the 308 Win. calibre are loaded. However already at this stage it was necessary to deal with some potentially awkward pitfalls: Due to the different specific densities of the lead which forms the core of the Soft Point bullets, and of Tombak (CuZn_{10}), which was chosen as the basic material for the new bullet, it was clear that the homogeneous bullet would have a greater volume – in order to achieve the same weight as the Soft Point bullet. However the overall dimensions of the cartridges and bullets

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are determined in accordance with the technical parameters of the magazine. A deeper recess for the guiding part of the bullet to the cartridge inevitably causes an increased pressure of powder gases, which are, however, restricted according to C.I.P. safety regulations. So where to add and where to reduce? Use a different composition of powder? Or is the best way through an adaptation of the charge? Is it a question for corporate metallurgists or for chemists?

Search for the optimal shape

On the drawing board and computer monitors different shapes of the guide were created; different options for the grooving were explored, i.e. depth, width and the spacing of the individual grooves, which influence the interior ballistics of bullets. The grooving helps to improve the guiding of the bullets in the barrel, reduces both material and environmental resistance and eliminates wear-and-tear on the barrel. On the other hand, it also affects the weight of the bullet. How to cope with the grooving, bearing in mind the requirement for maintaining the weight of the bullet? More new challenges, more new solutions.

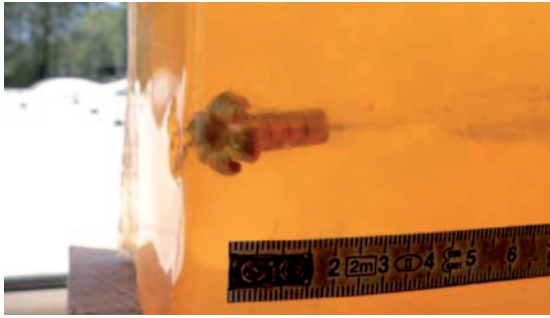
In Ing. Kratochvil's words:

"The daily ritual of discussions, tests and new initiatives was directed toward a single end – to comply with or at least to meet the defined requirements as closely as possible. In the beginning, with the machined bullet, we were testing the properties of a variety of materials and their behaviour during the deformation of the bullet. As materials, we were able choose between copper, brass or Tombak. Brass proved inadequate, copper would have caused excessive clogging and wear-and-tear on the barrels of the hunting weapons. In favour of Tombak, on the other hand, was considerable experience with its processing during manufacturing and for that reason the choice fell on Tombak wire as a starting material. When we had made the first prototypes and we brought them to the ballistic testing room, I really heaved a sigh of relief: extensive testing of the proposed design of the bullet had shown that achieving excellent accuracy would not be difficult. Shooting from the ballistic barrels, as well as from functional weapons was bringing very satisfactory results in the dispersion achieved when firing from 100 and from 300 metres. So the toughest nut to crack during the work proved to be the deformation of the bullet. I do not mean to achieve the controlled deformation, but how, through the correct design of the cavity and of the longitudinal grooves, to initiate the deformation at the right moment." From

previous experience, the team, led by engineer Milan Musil, who coordinated from the development work on the new bullet the beginning, knew that several paths could lead to the achievement of the objective. One of these is the choice of the optimal shape for the cavity; other options are offered by the longitudinal incision of the cavity, which facilitates its opening to a star shape. Bullets with the cavity with three-, four-, five- and even six incisions had all been thoroughly tested. So how to ensure that individual ledges would not break off? That could be a side effect because a bullet with controlled deformation and a high residual mass would actually turn into a fragmenting bullet, which has different traumatic effects. This work required experts in the field of metallurgy to determine the precise annealing conditions of the body of the bullet and to achieve the desired hardness of the bullet. And another question: does the capping disc affect the controlled deformation?

"Maybe it's just a detail," shrugs Ing. Musil, "but in the scientific literature it is indicated that the capping disc has two functions: first, it protects the cavity and second it initiates the deformation of the bullet. And it was this second function which we had not confirmed. We dedicated a lot of time to shooting through slices of ballistic gelatine of various thicknesses, were the thickness simulates a hit on game with different vitality, and we endlessly explored the curves of the unfolding





The rate of deformation of the bullet, in addition to its controlled deformation, has been tested in blocks of ballistic gelatine

of the bullet into a star shape. But whether the capping disc could initiate the deformation of the bullet? This was not confirmed."

Accordingly, as the bullet was receiving its final shape, the time came to also address questions concerning its industrial production. Also the designers of the machinery and the equipment become involved in this aspect of the work. It was necessary not only to make the optimal use of the production capacity of the new technological facility, to match the various operations, to produce tens or hundreds of new tools, but also to handle the entire process of the instrumentation and control of the production.

The bullet is confronted by the requirements of shooters

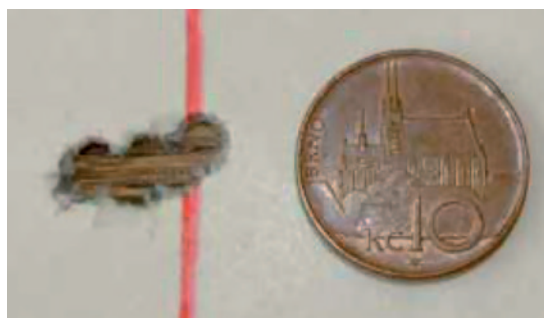
Wednesday, the 4th March 2008 was a very significant day for the new homogeneous bullet made by Sellier & Bellot. In the spacious meeting room on one side of the table sat the Representatives of the Company, opposite them the test shooters. During the previous five months, they had been testing the parameters of cartridges with a homogeneous bullet in practical use and now they were browsing through piles of catch records, which they were carefully filling in for each cartridge fired: the type of game, its gender, age and weight, its distance, position and activity prior to the shot, the shooting conditions, including the precise time and weather conditions, the position of the shooter, the behaviour of the animal after the shot, including marking, the distance of movement from the location where the game stood when shot... Designers are mainly interested in the behaviour of the bullet when it is passing through the animal's body, whether it change its direction or not and how it behaves following an encounter with a bone; also important

are the size of the entry and exit holes, the gauge of the projectile channel, the bleeding of the game and whether the bullet causes excessive degradation of the game or whether or not the intramuscular membranes are subject to the suffusion of the blood; also significant are the subjective experiences of the hunters.

And the results were very positive. For example Ing. Antonín Salva already, after the first few catches had so much confidence in the tested bullet and in its accuracy and in the cartridge drive, that he did not hesitate to use it to hunt the chamois of his "life", incidentally one of the most magnificent that has ever been hunted in Bohemia. His evaluation however, provides findings that were later also described by other shooters: that initial experience suggests that the bullet would be more suitable for hunting adult, heavier game, whereby the high terminal energy and the weight balance can be effectively utilised. On the other hand, when hunting deer and piglets, the bullet probably is not suitable, due to the lack of resistance of the body, to transmit enough energy.

"Departing game in some cases bleeds very weakly; it starts to bleed after twenty, thirty metres. I'm somewhat disconcerted in respect to the fact that no foaming of the blood occurs, no bubbles in the blood and body fluids, which would indicate a high level of traumatic shock but a lesser hydrodynamic impact," stated František Řehoř, who was using the homogeneous bullet for hunting big game in the Game Preserve in Poněšice. It is clear that although he caught a few dozen head, he was dissatisfied with the lack of marking of the departing game on the trail. Also Oldřich Konecký from Moravský Krumlov recorded a similar experience with the new bullet in the local game preserve. In many of the photographs, with which he documents his catches, he shows, on the contrary, how carefully the bullet treats venison. He appreciates that there is only low internal bleeding, as well as much lesser damage to the internal organs, in comparison with a soft-point bullet, as observed during the gralloch. And the overall summation of the shooters who were testing the homogeneous bullet loaded in cartridges of 308 Win.? Without any reservations, suitable for the hunting of adult hoofed game and heavier specimens of wild boar. To be equally suitable for hunting deer and other game of a similar weight, it is requisite to focus on the further development of the ability of the bullet to create a sufficiently wide wound channel and especially on the size of the exit hole, which also influences the sufficient marking of the trail.

The Gamekeeper, Vlastimil Švoma, who additionally brought several bullets that he had found, also agrees with this. The Kněžičky Game Preserve, where mouflon and fallow deer are kept, lies in the planar valley of the Elbe where, due to the sparse nature of the vegetation, with large open areas of free space, it is very difficult to approach game at a closer distance. Therefore he was shooting almost all game from a distance of 130 or more metres. He therefore did not observe the criticised traumatic effects of the bullet in such a clear manner as the previous shooters and additionally the bullets which he found were unfolded into a star shape, in an almost clichéd manner. Even with the naked eye it is apparent that, even after passing through game, they did not lose any part of their weight. But perhaps the 300 Win. Mag. calibre is more compatible with the new bullet and the bullet is better able to take advantage of the higher performance, in comparison with the previous 308 calibre Win.? This would also confirm the findings of Pavel Konečný, from the Soutok Game Reserve, who, together with other shooters, was testing the parameters of the homogeneous bullet of the 30-06 Spring. calibre. Ing. Ladislav Karásek also came to the meeting in Buchlovice with interesting findings. *“When shot in the shoulder blade, the big game behaves in the same way as after being shot in the spine; collapses on the spot where it been shot and shows signs of complete paralysis. When galloping I discovered the explanation; by impacting the shoulder blade a strong shock to the ribs occurs and it is their violent impact against the spine that causes immediate paralysis of the*



Accumulation of five shots at a distance of 100 metres confirms the high precision of the eXergy bullet

game. Since the vital organs have also been affected, including the heart, the game does not stand up as it does after a paralyzing shot.” Also in other shooters’ evaluations there have not been any reservations in regard to the traumatic effects of the bullet; on the contrary they considered them as fully comparable to the traumatic effects of the commonly used SP and SPCE bullets.

“Yes, but you all were shooting adult big game and wild boar or fawns in winter, when they weight sixty, eighty kilos,” states František Řehoř, summarising the findings. It seems that the truth is on his side: the new bullet is well proven when hunting adult vital game, also causing it fatal injuries in cases in which, in terms of the organs affected, the shots, were not perfect. The determining factor remains the size of the wound channel and, in particular, the size of the exit hole, which the shooters, regardless of the calibre used, were finding with a diameter of 1.5 – 3 centimetres,

Table of the ballistic values of the Sellier & Bellot cartridges loaded with the eXergy bullet

	Product No.	Bullet No.	Type	Weight	
				grs	g
7×57	SB 34003	2968	XRG	10.2	158
7×57 R	SB 34004	2968	XRG	10.2	158
7×64	SB 34007	2968	XRG	10.2	158
7×65 R	SB 34005	2968	XRG	10.2	158
7 REM. MAG.	SB 34006	2968	XRG	10.2	158
308 WIN.	SB 34000	2970	XRG	11.7	180
30-06 SPRING.	SB 34001	2970	XRG	11.7	180
300 WIN. MAG.	SB 34002	2970	XRG	11.7	180
8×57 JS	SB 34008	2977	XRG	12.7	196
8×57 JRS	SB 34009	2977	XRG	12.7	196

rarely larger. Especially in the winter season, when the game has a thick winter coat, tracking could cause a considerable problem for many hunters, due to the lack of marking. Many hunters, if they did not, at the same time, notice any marking of the wound, would consider the game to have been missed and they would not follow the departing game, thereby finding the first blood after a dozen steps.



Searching for the final solution

“So we’ll keep working on these parameters,” Ing. Radek Musil said, concluding the first round of the practical examination. Proposals are discussed about how to solve the problem: to change the shape and size of the bullet ledges or to change their number? To further modify the hardness by annealing? Change the driving charge, i.e. the velocity of the bullet and its impact energy? Is there any possibility of another manner of timing the controlled deformation of the bullet? More and more questions, more and more new ideas. Nobody wants to leave, neither hosts nor guests.

The target is defined and now the methods are being sought for. In play are the satisfaction and the confidence of future customers. The findings of the shooters – nineteen of them attended the verification tests and steadily shot over a thousand rounds of cartridges and hunted a few hundred items of game – were carefully analysed. Over and over again, the company employees pored through their records, examining the behaviour of the bullet when hitting the various types of game, seeking links between the weight of the game and the shooting distance. The findings and the perceptions of individuals turn into stark statistics: 69 % of the game marked from the hit, 29 % percent of the game remained in the location where they were shot, 8 % of the game left the location where they were shot to a distance of more than 100 metres (the furthest distance recorded was 600 metres in the case of a female fallow deer weighing 45 kilos, after being shot in the belly).

These figures correspond to the statistics from the use of lead bullets.

Therefore the decision reached reads: We will continue to experiment with the hardness of the bullet and with the velocity at which the bullet after the hit unfolds into a star shape. Will the way forward be to change the number of the transverse grooves and the ledgers of unfolded bullet? Also this is necessary to verify in practice. And additionally at this stage, the shooters are requested, according to the circumstances, to also try shooting at game standing right beside them, at departing game or under conditions in which a responsible shooter would avoid shooting.

The tasks are specified. Normal times are returning to the constructors’ offices, the workshops and also to the testing room. Swiftly the shape of the bullet is adjusted, the optimal hardness of the material is sought for by annealing; the testing room examines how these adaptations have affected the interior and exterior ballistics of the bullet. After several weeks of testing, shooters are receiving the new series of cartridges, which respect their findings. The homogeneous bullet is, at this stage of the testing, incised with three, five or six threads. Now is the time, in the upcoming autumn season of 2008, to test the effectiveness of the modifications. When the testing shooters will, after a few months, discuss again, they will agree with the conclusion that the adjustments to the shape of the bullet and its unfolding to a different number of ledgers have no significant effect on the ballistics and the high level of accuracy. The good news is that the adjustment of the hardness of the material has altered the timing of the transformation of the bullet into a star shape. While in the first series the bullet was already deforming when passing through the coat and the subcutaneous membranes, now the resulting cavern has shifted to the muscle, i.e. to the body of the affected game. The game’s marking is considerably improved, is more sensitive to the shot; the percentage of the game that remains in the location where it was shot increases statistically. But what has not changed is the small exit hole and thereby the lack of marking by game on the trail. These findings are examined in terms of experience with comparable homogeneous bullets from other manufacturers and it is concluded that this phenomenon is characteristic for this type of bullet and cannot be significantly changed even by adjusting the shape and material.

Luboš Frank, the game keeper of Láňy Forest Administration summarises the properties and parameters of the new bullet in terms of its hunting

usability: *“I tested Sellier & Bellot cartridges with homogeneous bullets of the 30-06 Spring. calibre and I can honestly state that it was a very pleasant experience. I did have the advantage that I carried out these tests at an advanced stage of the development process, when the bullet had already almost achieved its final form and all the experience and findings of my fellow hunters had been taken into account. I hunted sika, fallow deer, wild boar and deer of 18–90 kg in weight, I was shooting at well tracked game, but also during drive hunts, at distances of from 50 to 200 metres. Although the diverse hunting conditions were not always ideal, I evaluate the new bullet very positively. It is precise, very stable in its trajectory also during a collision with a minor obstacle and its traumatic effects meet the requirements for a successful hunt. Well-hit game marks significantly, generally remains in the location where was shot and, if it departs, this will only be for a minimum distance, and it dies quickly. The bullet is at the same time very friendly to the venison, which does not break; hematoma occurs only in the immediate vicinity of the wound channel. One difference compared to soft point or other lead bullets is the already-mentioned smaller exit hole and therefore weaker marking; the blood remains in the game and it needs the fastest possible treatment. My experience is entirely positive, and I am convinced that the new bullet is, in its parameters and its effectiveness, fully comparable with the other bullets loaded in Sellier & Bellot cartridges.”*

The new bullet receives its name

The finale commences: on the basis of all the findings from the ballistic testing, from various technical experts as well as from the findings of testing shooters, the optimal variant of the bullet has been selected. It will now be sent to production

to make the first series under the conditions of mass production. This will be the reward, not only for the decision to implement new technological equipment for the production of the bullet, i.e. transfer presses, but it will also be a test of the ability and skill of the designers of the machinery and the equipment from Vlašim. It was, for example, necessary to design and produce a machine for inserting and pressing the aluminium tip into the body of the bullet. You can say, that this cannot be anything so complicated, but try just to weigh a tiny aluminium rivet. How to feed it into the machine, how to navigate it correctly, what strength to use for pressing it? Do you really think that this is just a detail?

And one more important thing: the bullet receives its name. Out of the many suggestions, the winning name is eXergy.

With the start-up of workshop production also comes the entire cycle of checking, measuring, testing and shooting, which again culminates in a practical re-verification by the shooters. Only their positive assessment of the new bullet can open the gateway for the new bullet eXergy and its journey to the customers. After two years of efforts, when the individuals in both development and production can finally be certain that they have not neglected any detail and met all the parameters that they were required to fulfil, the homogeneous bullet of the company's own design is finally ready. A lead-free bullet, a different bullet than the one that we were used to.

The Sellier & Bellot company can now offer customer eXergy bullets in the 308 Win., 300 Win. Mag. and 30-06 Spring. calibres. Currently, the final firing tests of bullets in the 7 mm calibre are being completed; during the next year it is planned to supplement the range with an 8 mm calibre, and other calibres in accordance with the customers' wishes.

Sellier & Bellot Recommends

Terms of use of Sellier & Bellot cartridges loaded with the eXergy bullet

With regards to the construction of the bullet, we can state that it is a tougher and stronger bullet, which undergoes a controlled deformation in the body of game but which has somewhat different characteristics than soft point bullets with a lead

core. During deformation, the front part turns into a radial shape along the five transverse grooves, while the rear part remains cylindrical and compact. This compactness and the consistency of the bullet prevent the entirely undesirable phenomenon,



which is familiar in the case of jacketed bullets, whereby the bullet sometimes decomposes into several fragments. Along with the above-average high residual mass of the bullet after passing through the body of the game, it guarantees a reliable traumatic effect, which is created by its perfect penetration through both of the two halves of the body of the game, even after a hard body part such as a joint or the spine has been hit. The homogeneous, environmentally-friendly material of which the bullet is made does not contaminate the game, since the toxic effect of a lead bullet does not occur. When hitting the tissues of the game, lead fragments occur followed by subsequent degradation of the game in the area around the wound channel. If great accuracy is taken into account, as is demonstrated by shooting both with ballistic and hunting weapons by renowned shooters, which is shown by the results of an accumulation of shots from firing distance, we get an excellent evaluation in all the selected parameters. However the eXergy bullet cannot be considered in our hunting conditions as completely universal, allowing trouble-free hunting under all conditions. There is no such bullet. Use of the bullet for hunting game is viable, based on its favourable qualities that make it ideal for hunting semi-heavy and heavy more vital game

(adult deer and boars, as well as mature trophy fallow-deer, sika, American deer and mouflons), when it ensures its distinct and reliable traumatic effect. On the other hand, when hunting game of lower weight, such as roe deer, hoggets, females and calves of this hoofed game, this bullet due to its greater hardness is less suitable. In the case of this game, the effects of the bullet may decrease when it is passing through the soft tissues, due to its lower transmission of energy power and it causes just a clean penetration with small exit hole and thereby only a limited traumatic effect. In this situation we recommend shooting at medium and longer distances.

Hunting with cartridges loaded with the eXergy bullet will require, of course, a higher level of shooting discipline from hunters. Shots at game to the shoulder blade, neck, spine and locomotive system demonstrate a reliable traumatic effect and effective stopping power. Game, in the majority of cases, will remain in the location where it was shot and does not depart. In the case of muscle injuries, wounds to the gut, intestines and other soft tissues, however, we can encounter the more distant departure of injured game, which, of course, can also occur in the case of the usage of common types of bullets.

Despite its reliable traumatic effects the bullet is very considerate to the body of the game and to venison, which does not suffer significant damage. Only in exceptional cases (e.g. a wound to the spine) does it affect venison to any considerable extent. More likely is to encounter a larger hematoma in the intramuscular membranes, usually on the side of entry into the body of the game. Given the small size of the exit hole, it may even be overlapped by skin. In this case, the affected game will bleed internally, which may affect the extent of marking.

Due to its construction the eXergy bullet is stable in contact with minor obstacles (such as grass, grain, leaves and thin branches of trees and shrubs, etc.), however because of its greater tendency to rebound (e.g. off terrain, rocks, trees, etc.) it cannot be unconditionally recommended for shooting at short distances during drive hunts.

The availability of cartridges containing the homogeneous eXergy bullet is certainly a requisite and, especially, a most welcome extension to the product range. It satisfies particularly hunters of heavier and vital game, who also deal with shooting at longer distances.