5.56x45 Frangible

Fragmentation

Function in weapons

Accuracy at 10m range and at 100m range

CBJ Tech – Test protocol

Date: 2025-09-23	**Location**: Kungsbacka, Bunker (indoor test facility) Kungsbacka, Löftadalens Skytteförening (outdoor shooting range – 100m shooting distance)	**Weather conditions**: 5m/10m: Indoor, 21 deg C 100m: Outdoors, 13 deg C, Wind <5m/s
Weapon systems tested: Universal Receiver with 18”/460mm barrel, AK5 assault rifle with 18”/460mm barrel, Custom built rifle with 18”/460mm assault rifle barrel in caliber 5.56x45 Nato fitted.		
Ammunition tested: 5.56x45 Frangible – Projectiles from first 10.000 batch. 5.56x45 Nato STKPRJ 5 as reference ammunition.		
Targets tested: Steel box and paper targets.		
People present: Mikael Johansson, Bertil Johansson		

Background and Purpose

Frangible ammunition is defined as ammunition utilizing projectiles that are designed to fragment into very small pieces when hitting a hard surface. The purpose is to be able to use the ammunition during training against hard targets, like steel plates or poppers, without the risk of ricochets or fragments bouncing back, causing damage or injuries. Also bullets that unintentionally hit outside the bullet trap will cause less damage because of the reduced risk for ricochets and reduced penetration capability.

There are few alternatives on the market for 5.56x45 Frangible ammunition. Most known variants often fail by breaking apart during feeding in automatic cycling weapons, or during firing, which causes extremely unreliable cycling, and poor accuracy. The typical lower density of the material used in frangible projectiles limits the design parameters and these projectiles are often lighter that the original lead projectiles that the cartridge was designed for in the beginning, alternatively very long and hard to rotationally stabilize with normal twist rate in the barrels.

The alternatives that seem to function best uses projectiles with a core of Frangible material, covered by a copper jacket. The problem with these is that they cause too large fragments when hitting hard targets, which defeats the entire purpose of frangible projectiles.

5.56x45 Frangible developed by CBJ Tech

The design prerequisites for the 5.56x45 Frangible projectile designed by CBJ Tech, required that a projectile weight of 55 grains, or 3,6 grams, was achieved in order to stay within the normal projectile weight range for .223/5.56x45 Nato. This was to reduce potential problems with automatic cycling weapons. The projectile has a blunt nose, which moves the center of mass forward and increases stability, and also reduces the risk of ricochets when fired at angled targets.

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Another requirement was that the projectile should not require a jacket, but still manage to be loaded, fed from magazines and fired without breaking apart. It is also required to meet the requirements from Swedish authorities regarding fragmentation, which states that when fired into a steel box from 5m distance, no fragment may be heavier than 8% of the original projectile weight. In this case, that requirement translates to no fragment allowed heavier than:

3,6g x 0,08 = 0,288g

Goal of the test

The goal of the test is to verify that the 5.56x45 Frangible projectile developed by CBJ Tech meets all requirements for Frangible ammunition according to the Swedish authorities, as described above, as well as achieving an accuracy at 100m that meets the requirements set by NATO:

NATO STANDARD - AEP-97 - MULTI-CALIBRE MANUAL OF PROOF AND INSPECTION (M-CMOPI) FOR NATO SMALL ARMS AMMUNITION

This standard contains among other things requirements for accuracy for 5.56x45 Nato ammunition that states that 10 cartridges shall be fired at a distance of 550m and the standard deviation horizontally and vertically must not exceed 200mm. Since the projectiles are supersonic at this distance, it should be defensible to mathematically recalculate this requirement for 100m instead:

100/550 = 0,1818… => 200mm x 0,1818 = 36,36mm

So, recalculated to 100m, this accuracy requirement states that the standard deviation of 10 cartridges fired should be less than 36,36mm

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Test 1 Setup

A Universal Receiver was fitted with a 460mm long 5.56x45 Nato barrel. 10 shots were fired at 5m range into a steel box. The box is 1m deep and the distance is measured to the back wall of the box. The front wall has a hole cut in the center that the projectiles passes through.

After shooting, the top lid of the box was opened, and all the fragments were carefully collected.

Result test 1

The fragments were collected, and the largest ones were separated and weighed. The heaviest fragment weighed 0,11g, which is well below the required maximum weight 0,288g.

Test 2 Setup

A Universal Receiver was fitted with an 18”/460mm long modified barrel from an assault rifle. 10 series of 10 cartridges was shot at 10m range on an indoor shooting range. The test was set up with 2 targets, one behind the other matching the edges perfectly. After the first 10 round series was shot, the rear target was replaced with a new one and the front target was kept in place. This procedure continued during the 10 series, giving 10 individual targets with 10 rounds each, as well as one target with 100 rounds.

10 ring paper targets were used for the test. The size of the targets is 170 x 170mm and the distance between the rings is 8mm

See the results on the next page and forward. All targets are shown at 100% scale.

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Results test 2

Series 1 – 10 rounds

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Series 2 – 10 rounds

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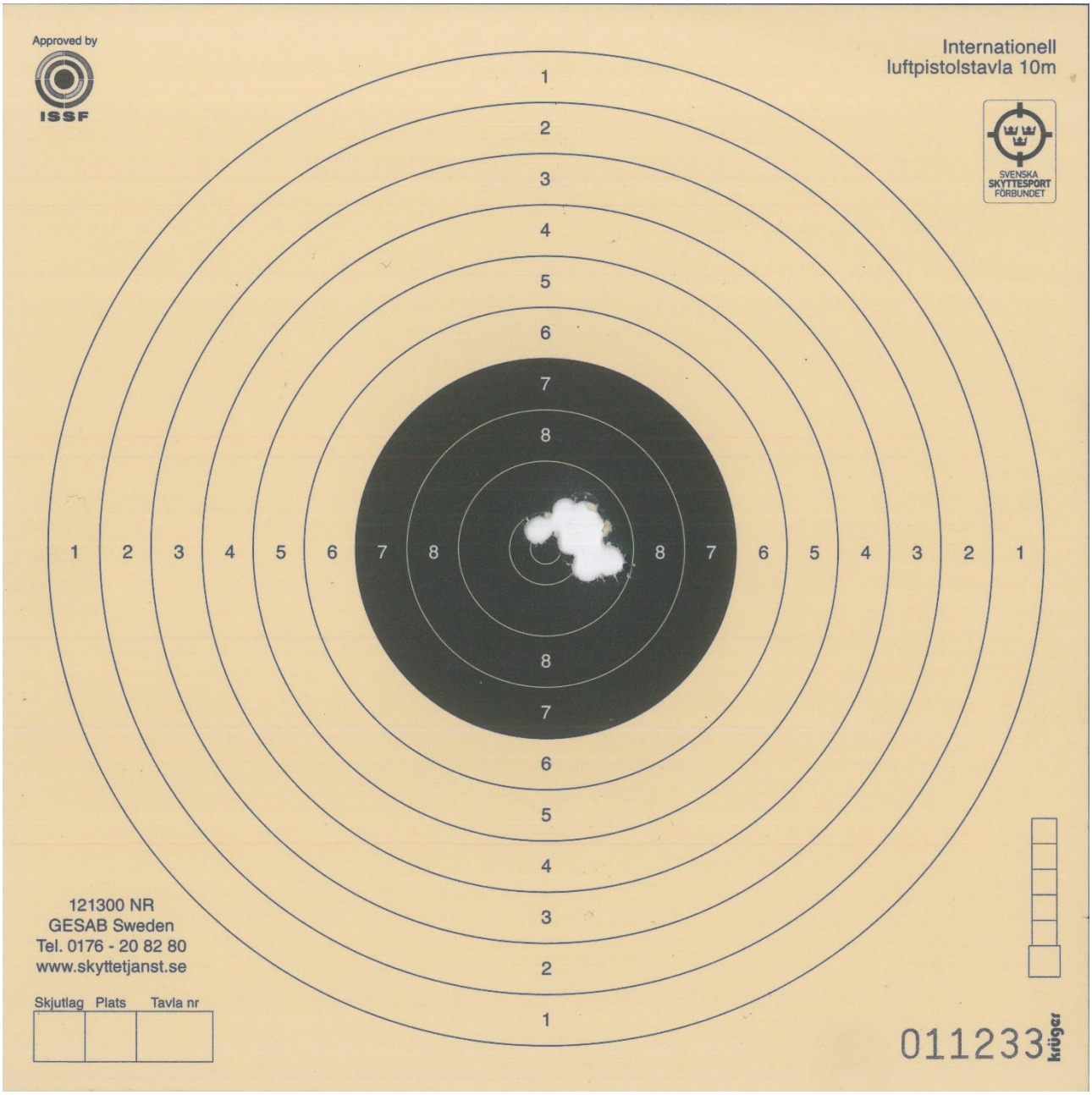
Series 3 – 10 rounds



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Series 4 – 10 rounds

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Series 5 – 10 rounds

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Series 6 – 10 rounds

CBJ Tech – Test protocol

Series 7 – 10 rounds

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Series 8 – 10 rounds

CBJ Tech – Test protocol

Series 9 – 10 rounds

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Series 10 – 10 rounds

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Series 0 – 100 rounds
This is the combined result of series 1 to 10.

Test 3 Setup

An AK5 with an 17,7”/450mm long barrel was used to test feeding and extraction to verify that the frangible projectile does not cause problems with cycling due to the blunt nose shape.

The weapon was loaded with a magazine with 10 rounds of 5.56x45 Frangible, and fired from a sitting position with support. The test was done at the same indoor shooting range as Test 2. The orange square patch was the aiming point, and above the center of the pattern due to the short range.

Results test 3

The picture shows that the accuracy when shot in an assault rifle is comparable to the result when shot with the Universal Receiver. No issues with feeding, extraction or cycling was observed. The average velocity measured 2m in front of the barrel was 878,3m/s

Test 4 Setup

A custom-made rifle was fitted with an 18”/460mm long modified barrel from an assault rifle. This rifle was used at an outdoor shooting range. 6 series of 10 rounds was shot at 100m range. The weather was sunny, 13 degrees Celsius and there was no noticeable wind.

5 series was shot 10 rounds each with 5.56x45 Frangible ammunition, and one series with 10 rounds was shot with reference ammunition with conventional FMJ projectiles – 5.56x45 Nato STKPRJ 5, which is standard Swedish military ammunition.

Cardboard paper targets fitted with 50mm diameter orange aiming dots were used for the test.

The shooting position was sitting with bench rest. The weapon was supported with soft sandbags to ensure optimal aiming conditions and reduce bounce/jumping during recoil.

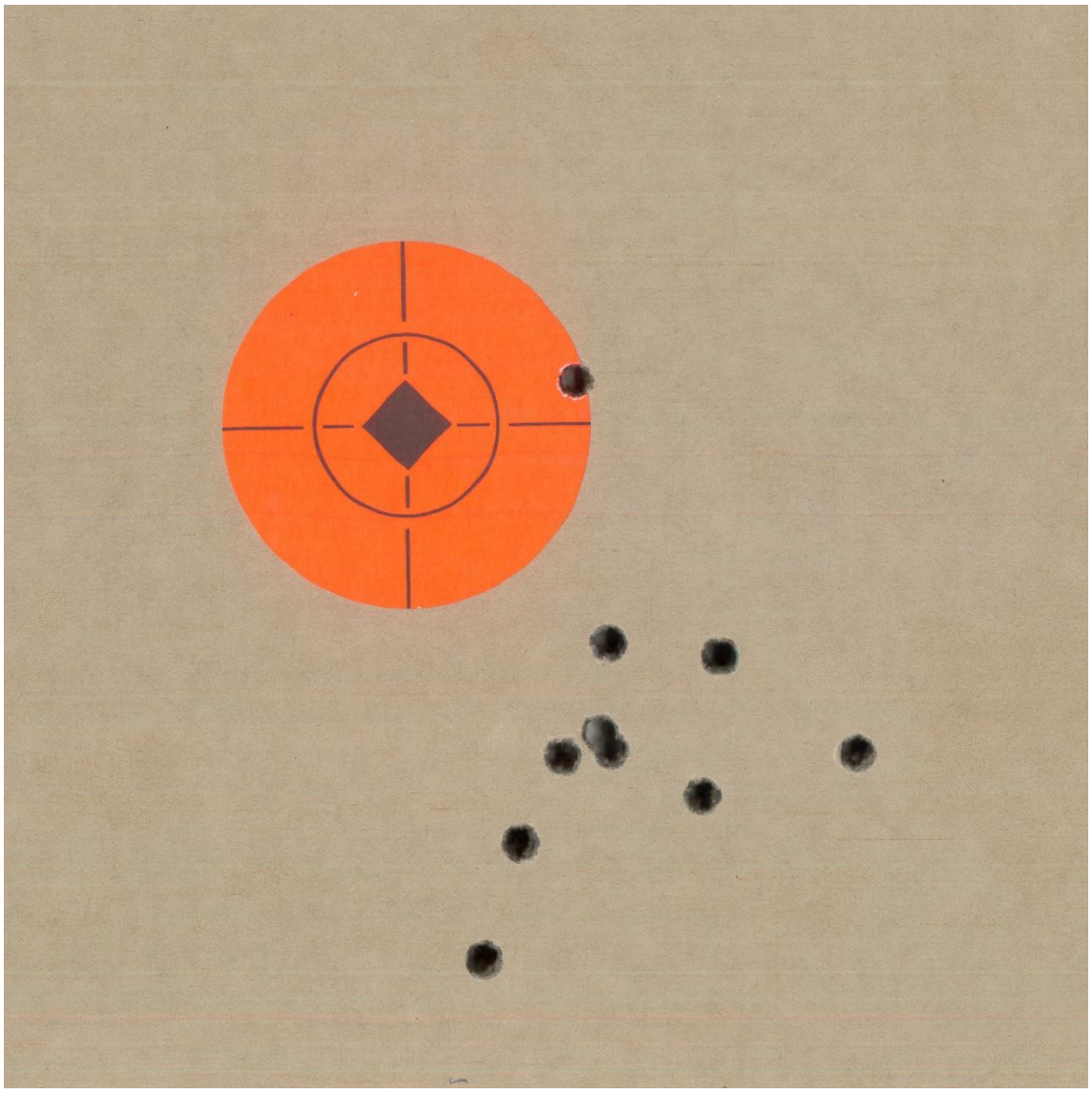
See the results on the next page and forward. All targets are shown at 100% scale.

Results test 4

Series 1 – 10 rounds 5.56x45 Frangible. After this series was shot the optical sight was adjusted up and to the left to better center the hit pattern. All the other series had the same setting for the sight.

Series data:
Extreme spread: Horizontal: 52mm – Vertical: 80mm

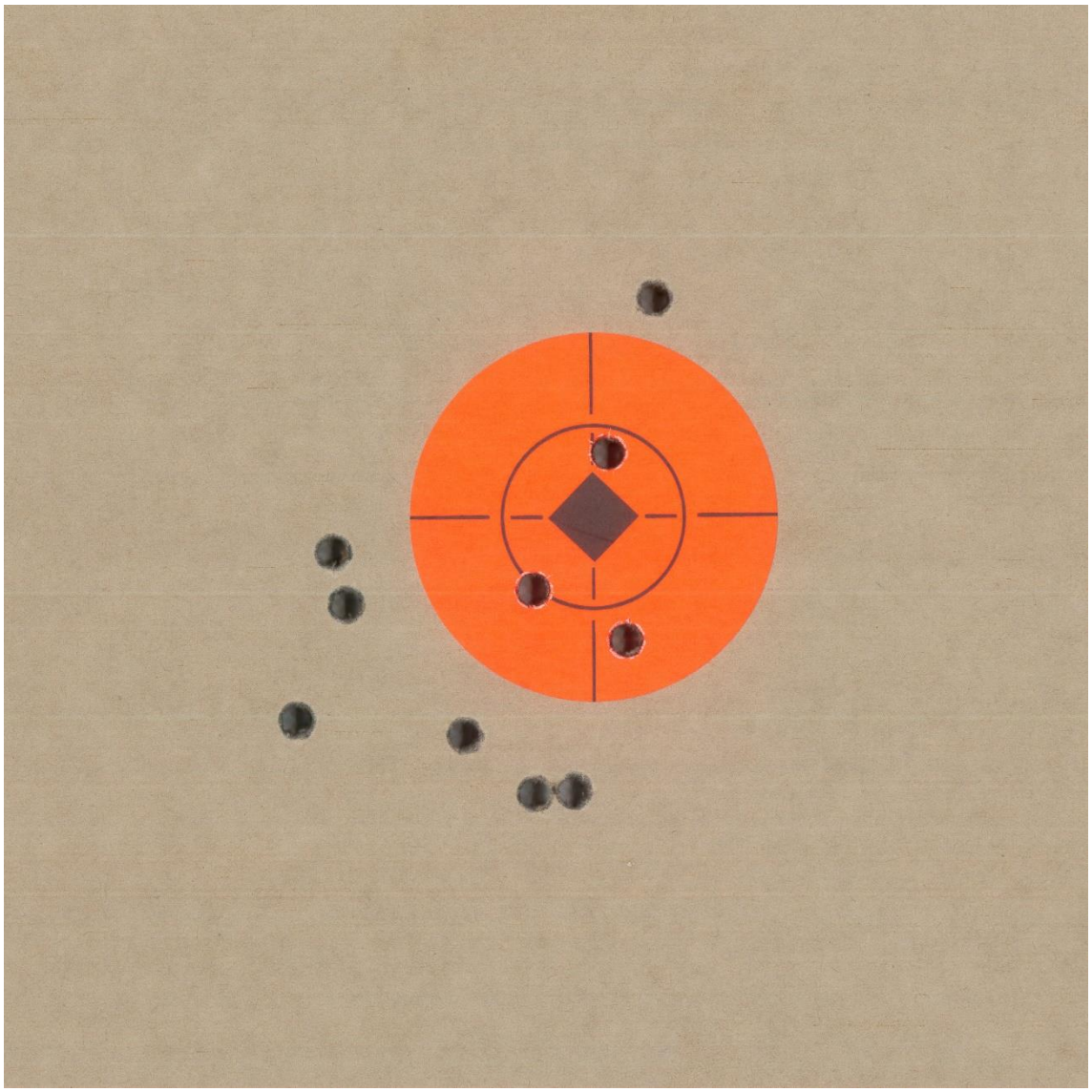
Standard deviation: Horizontal: 14,4mm - Vertical: 19,8mm



Series 2 – 10 rounds 5.56x45 Frangible. This and the following 4 series was shot with the optical sight adjusted up and to the left to better center the hit pattern.

Series data:
Extreme spread: Horizontal: 55mm – Vertical: 69mm

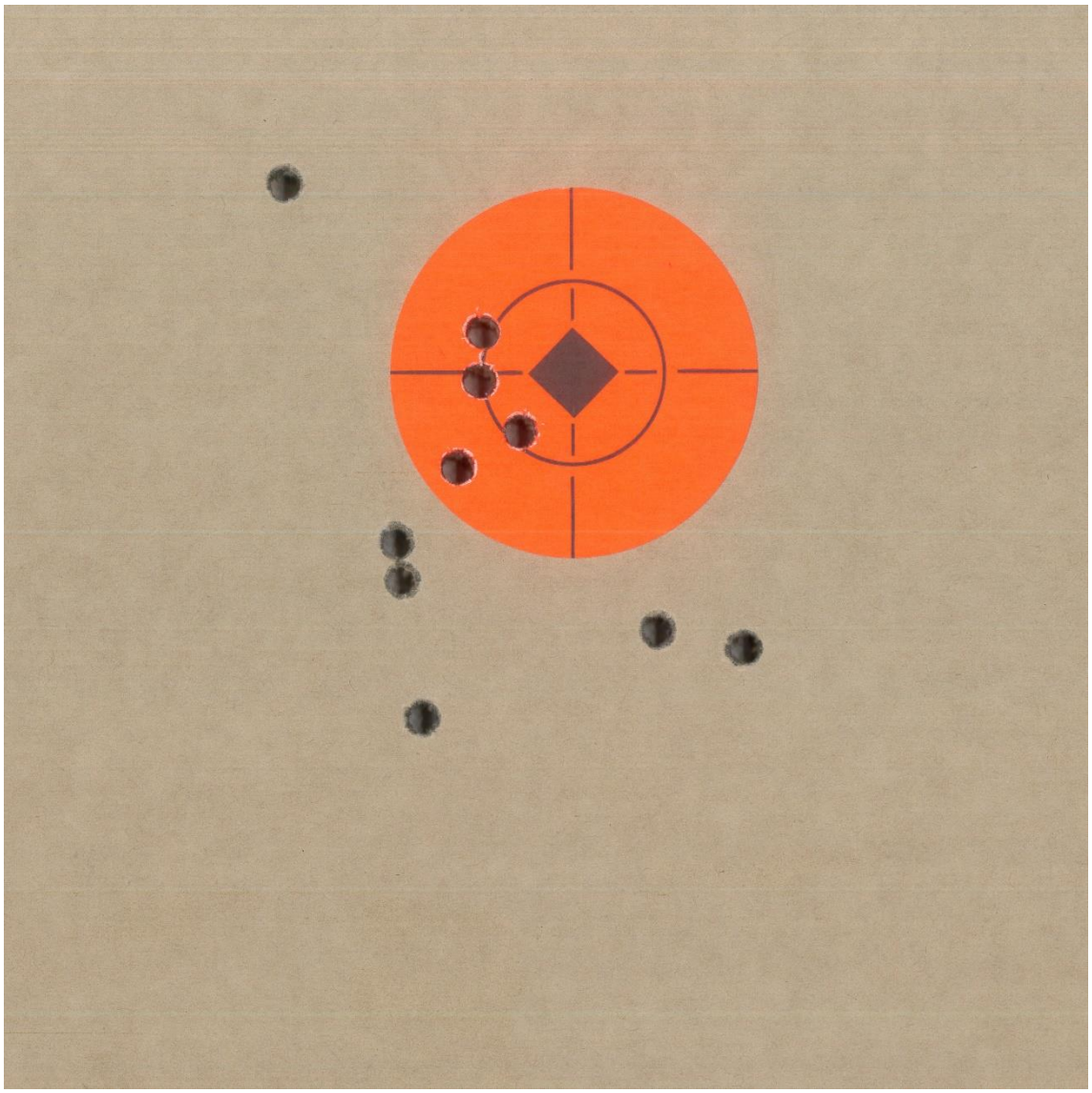
Standard deviation: Horizontal: 18,1mm - Vertical: 20,7mm



Series 3 – 10 rounds 5.56x45 Frangible.

Series data:
Extreme spread: Horizontal: 64mm – Vertical: 74mm

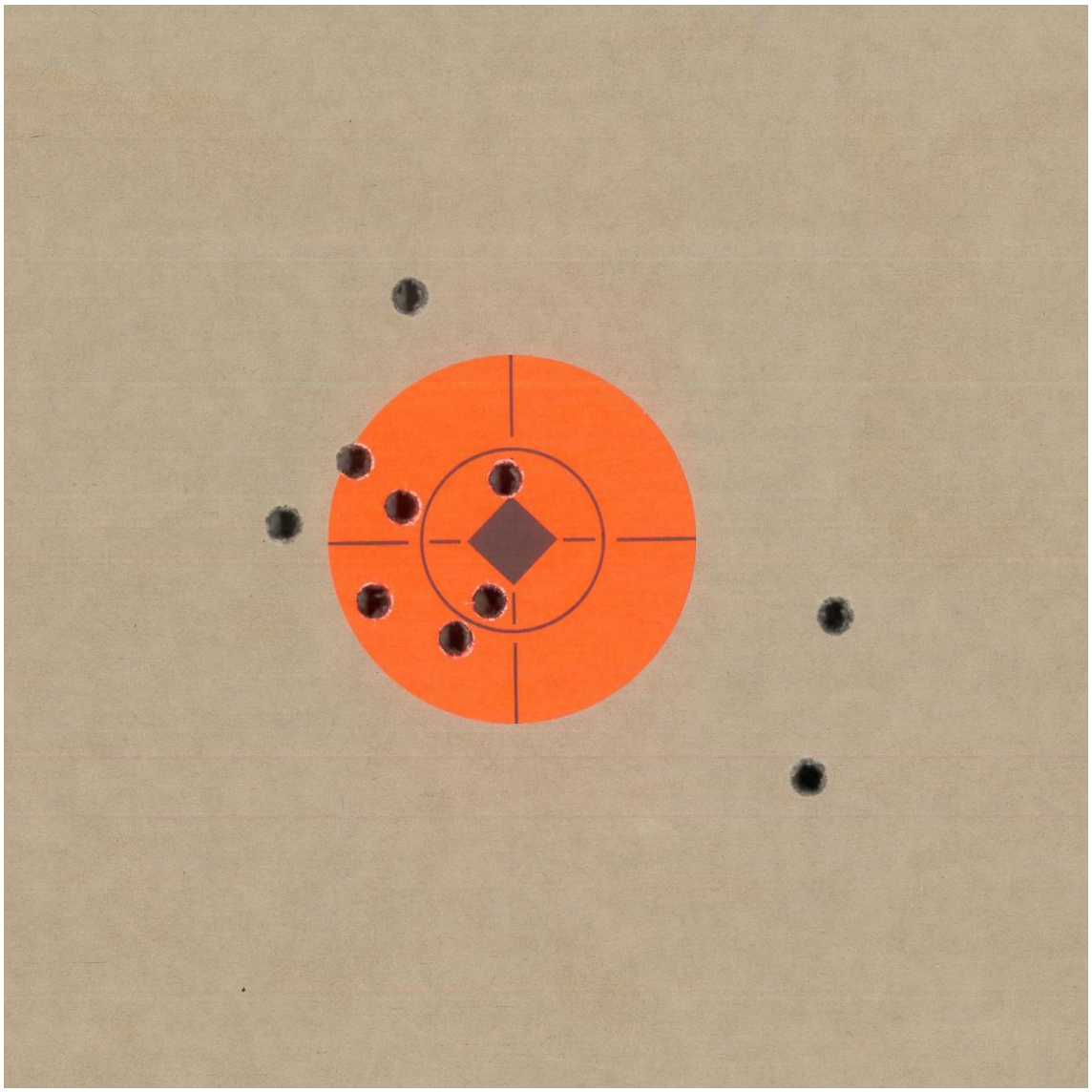
Standard deviation: Horizontal: 17,6mm - Vertical: 21,5mm



Series 4 – 10 rounds 5.56x45 Frangible.

Series data:
Extreme spread: Horizontal: 77mm – Vertical: 66mm

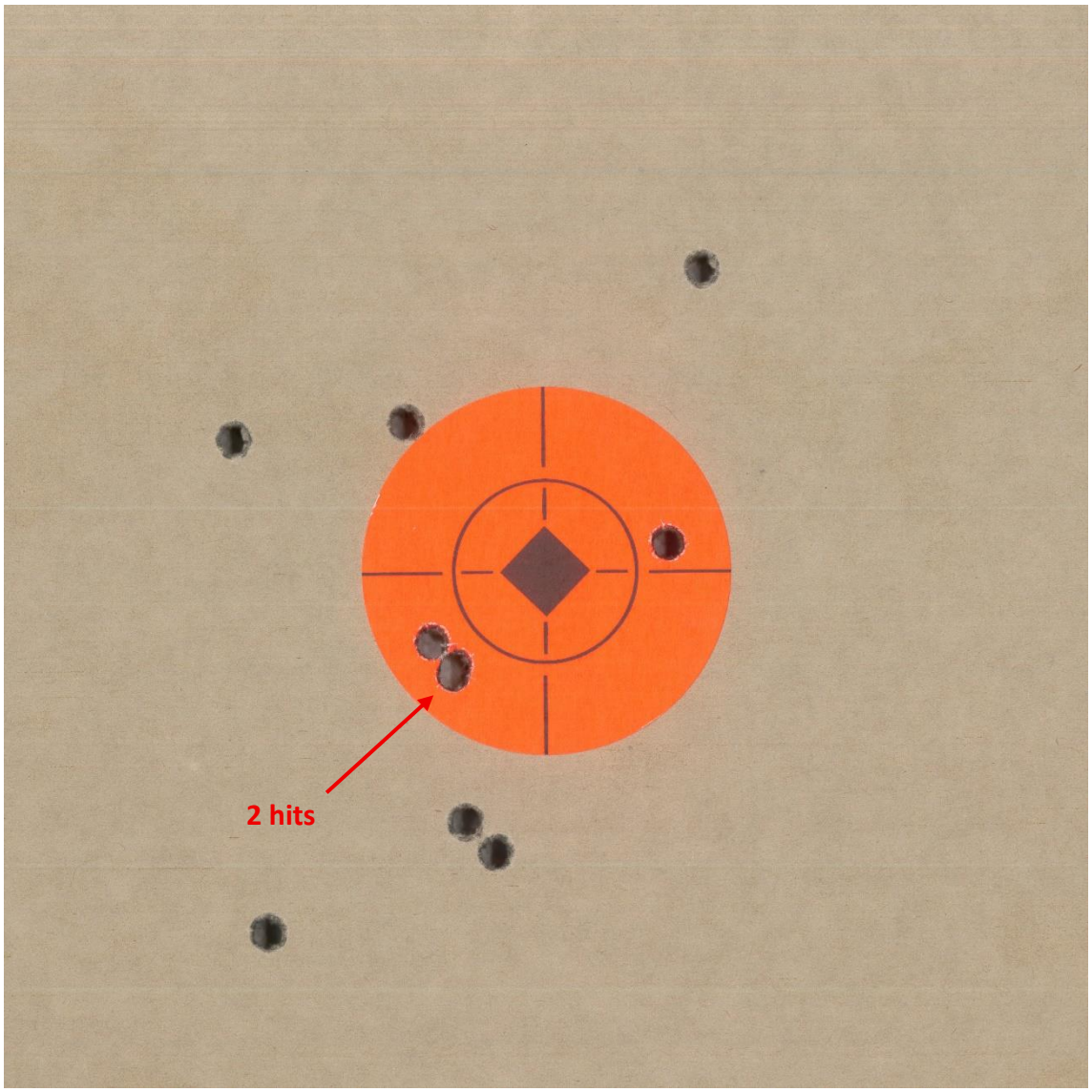
Standard deviation: Horizontal: 24,5mm - Vertical: 16,6mm



Series 5 – 10 rounds 5.56x45 Frangible.

Series data:
Extreme spread: Horizontal: 64mm – Vertical: 91mm

Standard deviation: Horizontal: 19,3mm - Vertical: 27,5mm

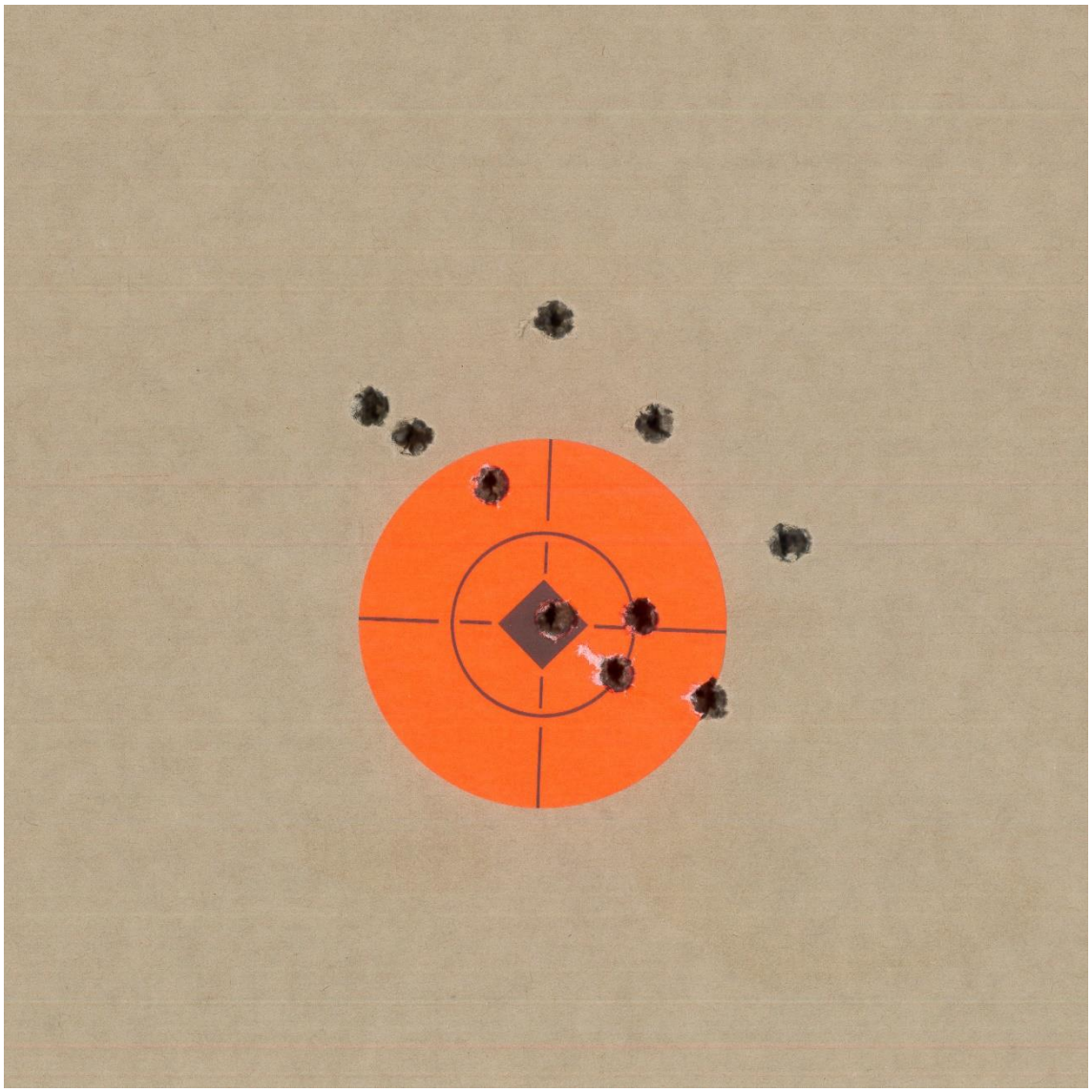


Series 6 – 10 rounds 5.56x45 Nato STKPRJ 5.

This was a reference series, shot with conventional FMJ type ammunition used by the Swedish military. All other conditions were identical to the other series.

Series data:
Extreme spread: Horizontal: 58mm – Vertical: 53mm

Standard deviation: Horizontal: 17,1mm - Vertical: 16,8mm



Summary

The fragmentation test showed that the 5.56x45 Frangible projectile developed by CBJ Tech does meet the requirements from the Swedish authorities regarding fragment weight. The allowed highest weight was 0,29g and the heaviest fragment found weighed 0,11g.

Through the weapon function test, it was shown that the 5.56x45 Frangible cartridges was shot without malfunctions with an accuracy at 10m indoors that is comparable to that of the Universal Receiver under the same conditions (barrel length, shooting distance, temperature etc.)

The accuracy tests were done in two phases, first at 10m indoors with a Universal Receiver to eliminate as many influences from the shooter and weapon system as possible, and then in phase 2, outdoors at 100m range.

At 10m it was impossible to distinguish every hit, so it was not possible to calculate standard deviation, but the hit patterns show that the hits were stable (no noticeable yaw) and that there were no obvious hits that were clearly away from the others, also known as flyers.

At 100m range it showed that the accuracy is not proportional to the accuracy at 10m. This is due to the normal slight yawing of the projectiles as they leave the muzzle and stabilize in the air a few meters in front of the muzzle. This is why the hit patterns at 100m are not 10 times larger than the hit patterns at 10m

The test showed that NATO's requirement for accuracy, translated to 100 m, which is a standard deviation of less than 36,36mm vertically and horizontally for 10 rounds, was clearly met by the 5.56x45 Frangible ammunition.

When studying the hit patterns at 100m it is observable that no holes were oval shaped, indicating that all the hits were stable. Also noticeable is that the center for the different series (after the sight was adjusted) was very similar to the reference series with conventional ammunition. This shows that there is no need to compensate for the impact point during exercises with frangible ammunition with a weapon zeroed for conventional ammunition.

To conclude, this report shows that the 5.56x45 Frangible meets the requirements described in this report regarding fragmentation, function in automatic cycling weapons and accuracy.