6.5x25 CBJ

Wound profile method in ballistic gelatin 10% combined with barriers

CBJ Tech – Test protocol

Dates: Between 2020-04-24 and 2022-10-07	**Location**: Kungsbacka, Bunker (indoor test facility)	**Weather conditions**: Indoor, 21 deg C
Weapon systems tested: Glock 17 gen 3 in 6.5x25 CBJ, HK MP7, BT MP9 in 6.5x25 CBJ and FN P90.		
Ammunition tested: 6.5x25 CBJ APDS, 9x19mm Speer Gold dot (124gr JHP) 4.6x30 NM257 (Nammo) and 5.7x28 SS190.		
Targets tested: Ballistic gelatin 10% @+4 deg C.		
People present: Mikael Johansson, Bertil Johansson		
Additional information:		

Background, Purpose and Goal

Ballistic gelatin is commonly used to evaluate the terminal effect of small arms ammunition projectiles in living tissue. Many aspects of the terminal effect can be determined with proper knowledge about how to correlate between the generated cavities in gelatin and the performance in living tissue.

The purpose of this test is to evaluate the penetration depth and cavity size in bare ballistic gelatin as well as gelatin combined with barriers, like body armor panels and APC armor, when shooting the different weapons and respective cartridges.

The goal is to determine if the penetration depth and cavity size of the 6.5x25 CBJ APDS is similar to or better than the 9x19mm Speer Gold dot or the two main PDW cartridges on the market, namely the 4.6x30 and the 5.7x28.

Test Setup

All gelatin blocks have been prepared according to the internationally accepted wound profile method defined by Fackler and Malinowski. Water was heated to +50 deg C and 10 weight percent gelatin powder was added and immediately mixed properly. The solution was poured into forms and cooled to +4 deg C and maintained at that temperature for 96 hours. Each block was immediately shot after removal from the refrigerator. The size of the gelatin blocks is 250x220x350mm (Width x Height x Depth).

After shooting, the respective blocks were cut in 5cm thick slices, so that the permanent- and temporary cavity size could be measured every 5cm. The two largest cracks from the center of the cavity were measured and plotted in a wound profile showing the temporary cavity.

CBJ Tech – Test protocol

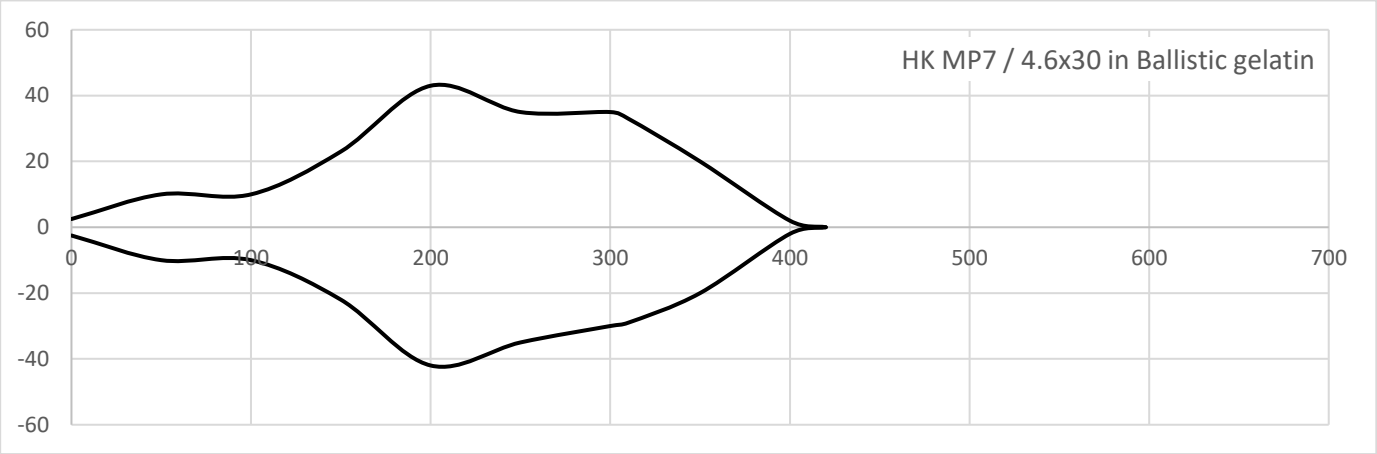
Test 1 – PDWs in ballistic gelatin

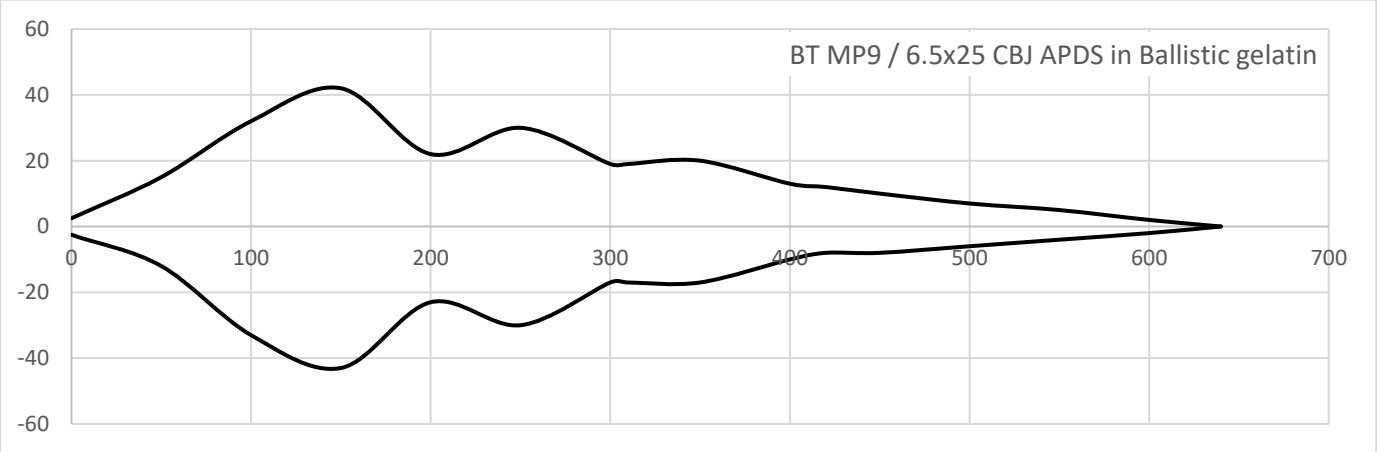
This test was done with a block of ballistic gelatin, to evaluate the performance of the respective PDW cartridges in unprotected soft targets. The distance to target was 10m.

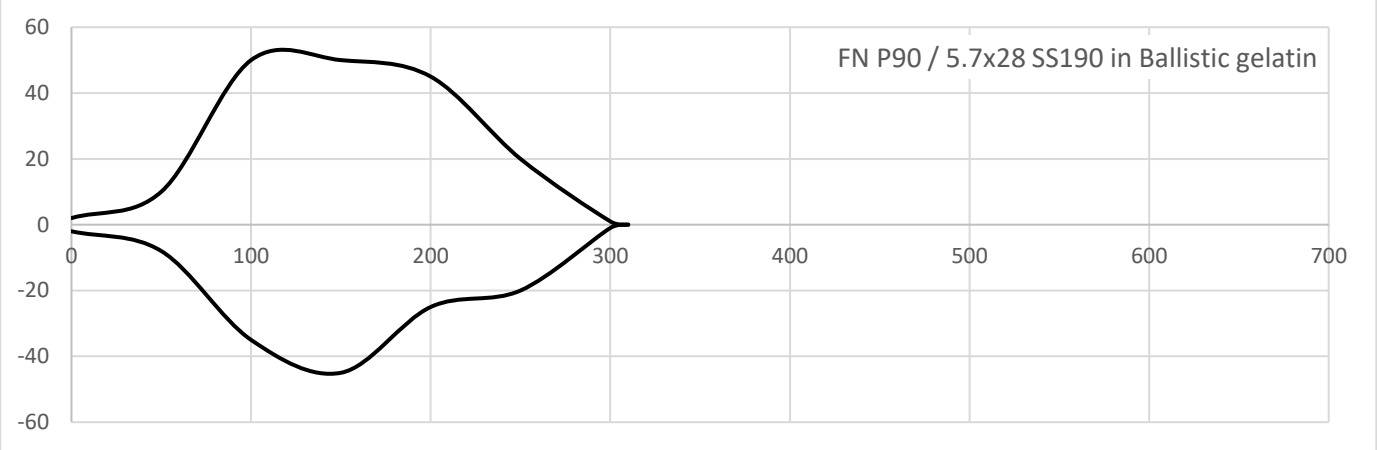
Weapon / Cartridge	**Distance / Cavity size [mm]**															
	0	50	100	150	200	250	300	310	350	400	420	450	500	550	600	640
HK MP7 / 4.6x30	2,5	10	10	23	43	35	35	33	20	2	0	-	-	-	-	-
	-2,5	-10	-10	-22	-42	-35	-30	-29	-20	-2	0	-	-	-	-	-
BT MP9 / 6.5x25 CBJ APDS	2,5	15	32	42	22	30	19	19	20	13	12	10	7	5	2	0
	-2,5	-12	-33	-43	-23	-30	-17	-17	-17	-10	-8	-8	-6	-4	-2	0
FN P90 / 5.7x28 SS190	2	10	50	50	45	20	1	0	-	-	-	-	-	-	-	-
	-2	-8	-35	-45	-25	-20	-1	0	-	-	-	-	-	-	-	-
Penetration depth [mm]:																
4.6x30	420															
6.5x25 CBJ APDS	640	(Sabot hit 30mm right of main cavity and penetrated 20mm gelatin. The gas check broke free from the sabot and penetrated 60mm gelatin)														
5.7x28 SS190	310															

CBJ Tech – Test protocol

Wound Profiles





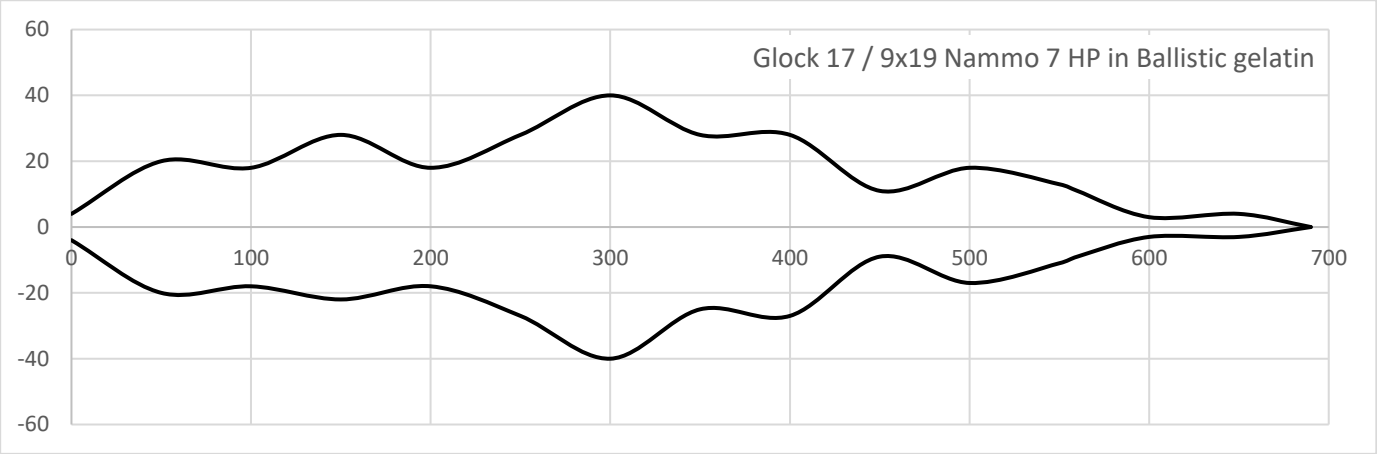


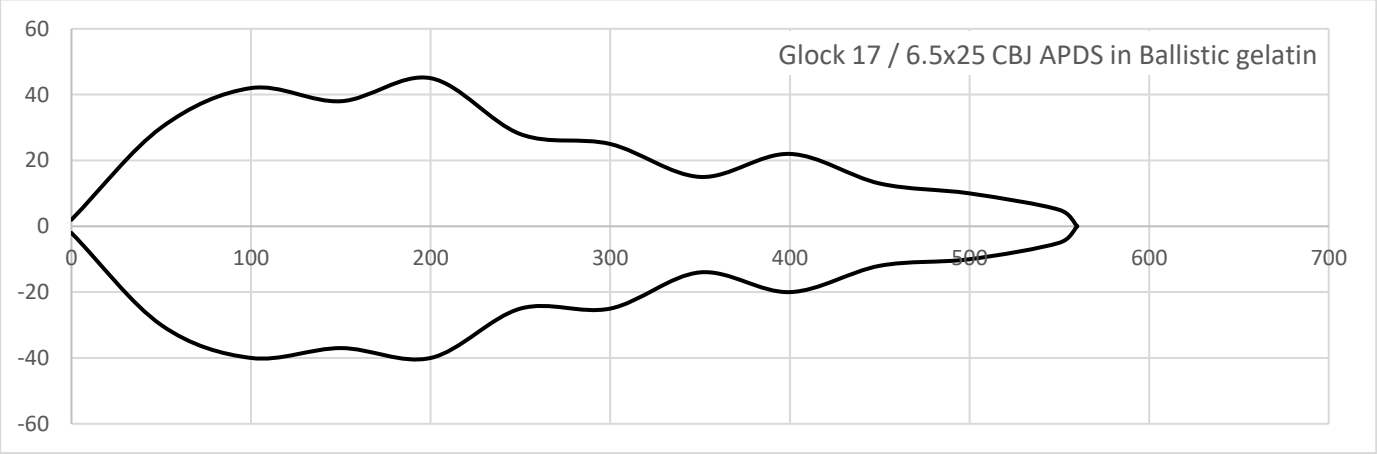
CBJ Tech – Test protocol

Test 2 – Pistols in ballistic gelatin

This test was done with a block of ballistic gelatin, to evaluate the performance of the respective pistol cartridges in unprotected soft targets. The distance to target was 10m.

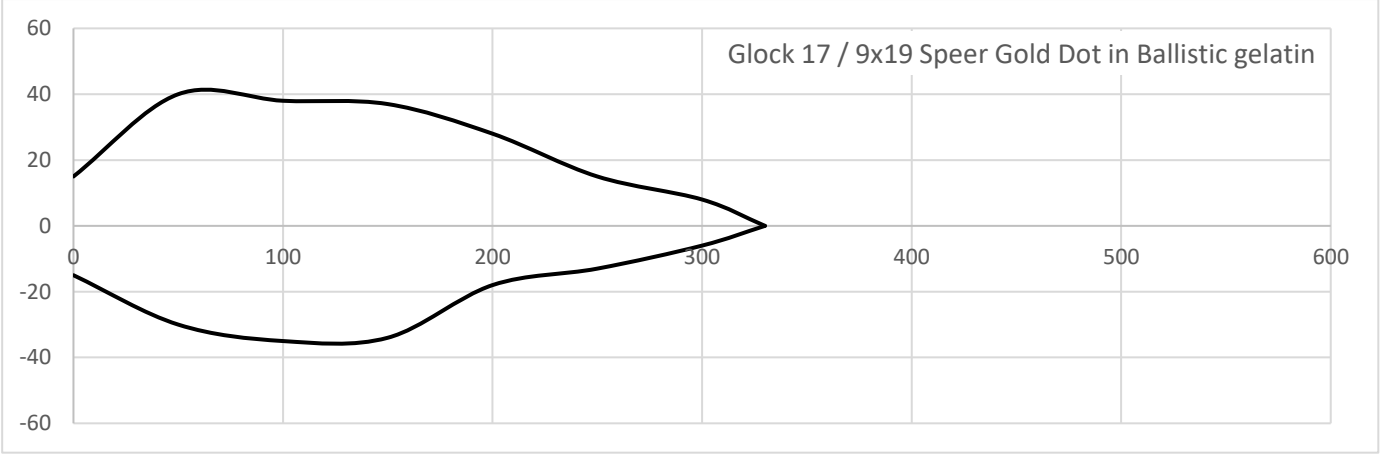
Weapon / Cartridge	Distance / Cavity size [mm]															
	0	50	100	150	200	250	300	350	400	450	500	550	560	600	650	690
Glock 17 / 9x19 Nammo 7 HP	4	20	18	28	18	28	40	28	28	11	18	13	11	3	4	0
	-4	-20	-18	-22	-18	-27	-40	-25	-27	-9	-17	-11	-9	-3	-3	0
Glock 17 / 6.5x25 CBJ APDS	2	30	42	38	45	28	25	15	22	13	10	5	0	-	-	-
	-2	-30	-40	-37	-40	-25	-25	-14	-20	-12	-10	-5	0	-	-	-
Penetration depth [mm]:																
9x19 Nammo 7 HP	690															
6.5x25 CBJ APDS	560															

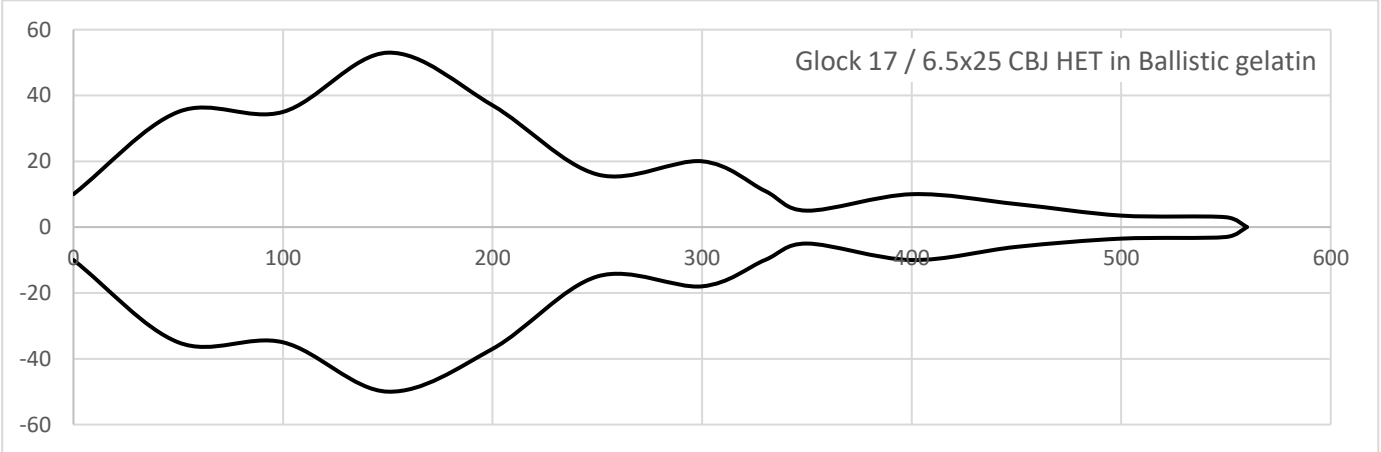




CBJ Tech – Test protocol

Weapon / Cartridge	**Distance / Cavity size [mm]**													
	0	50	100	150	200	250	300	330	350	400	450	500	550	560
Glock 17 / 9x19 Speer Gold Dot	15	40	38	37	28	15	8	0	-	-	-	-	-	-
	-15	-30	-35	-34	-18	-13	-6	0	-	-	-	-	-	-
Glock 17 / 6.5x25 CBJ HET	10	35	35	53	37	16	20	11	5	10	7	3,5	3	0
	-10	-35	-35	-50	-37	-15	-18	-10	-5	-10	-6	-3,5	-3	0
Penetration depth [mm]:														
9x19 Speer Gold Dot	330	(Lead fragment from one of the 6 opened sections found in gelatin at 140mm penetration depth.)												
6.5x25 CBJ HET	560													





CBJ Tech – Test protocol

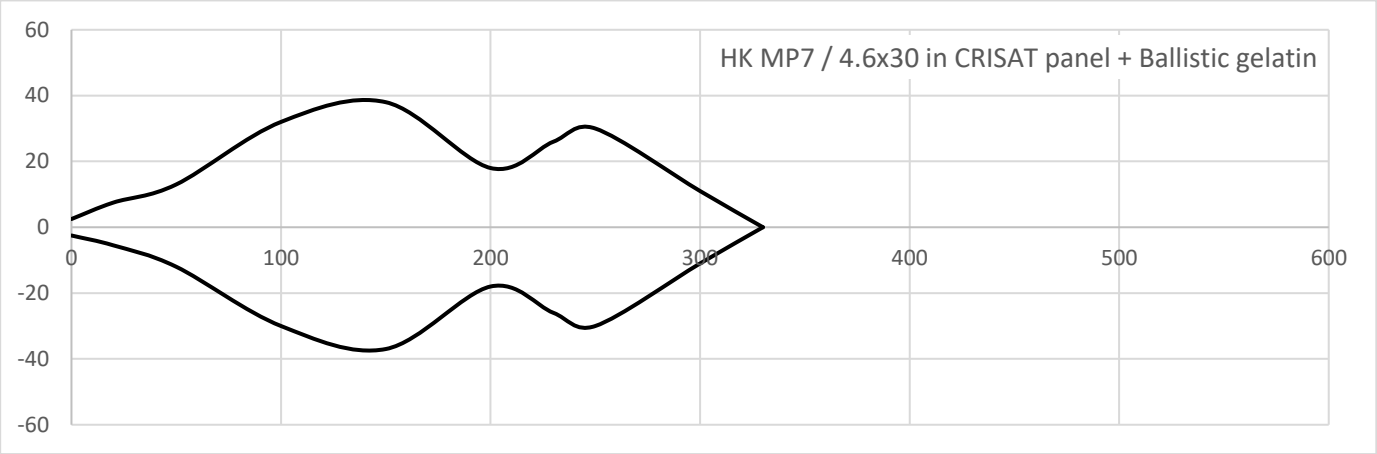
Test 3 – CRISAT + ballistic gelatin

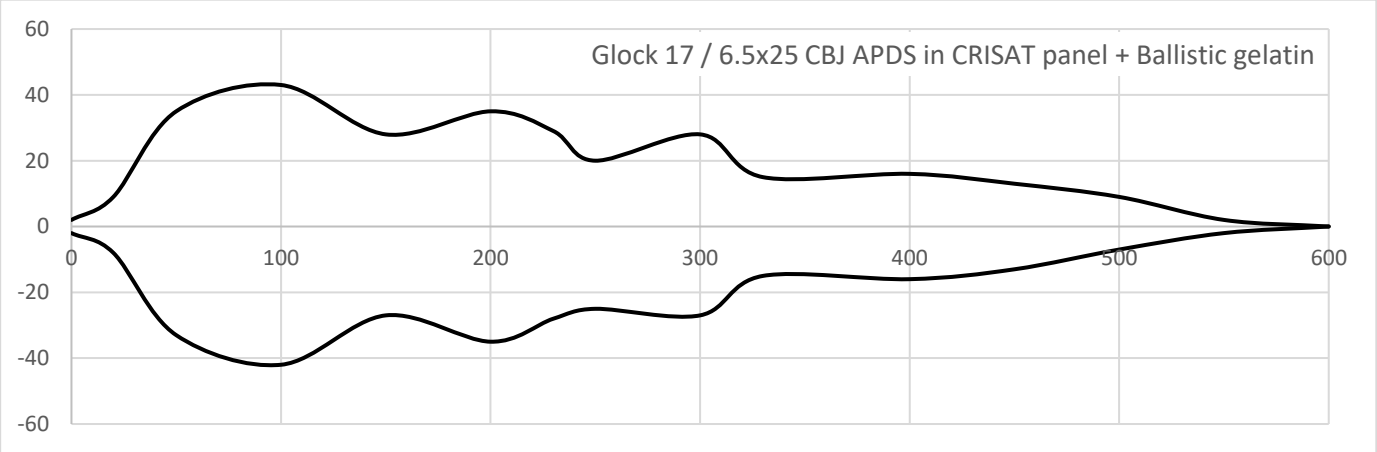
This test was done with a block of ballistic gelatin placed behind a CRISAT panel, which consists of a 1,6mm grade 5 titanium plate in front of 20 layers of Kevlar, to evaluate the performance of the respective pistol- and PDW cartridges. The distance to target was 10m.

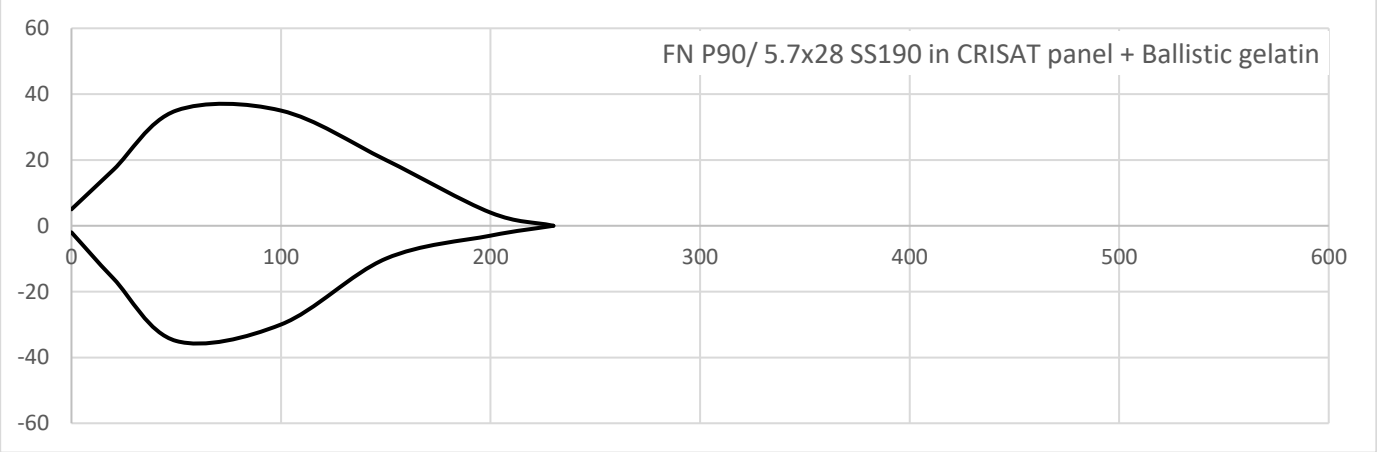
Weapon / Cartridge	**Distance / Cavity size [mm]**														
	0	20	50	100	150	200	230	250	300	330	400	450	500	550	600
HK MP7 / 4.6x30	2,5	7,5	13	32	38	18	26	30	11	0	-	-	-	-	-
	-2,5	-5,5	-12	-30	-37	-18	-26	-30	-11	0	-	-	-	-	-
Glock 17 / 6.5x25 CBJ APDS	2	9	35	43	28	35	29	20	28	15	16	13	9	2	0
	-2	-8	-33	-42	-27	-35	-28	-25	-27	-15	-16	-13	-7	-2	0
Glock 17 / 9x19 Nammo 7 HP	20	0	-	-	-	-	-	-	-	-	-	-	-	-	-
	-20	0	-	-	-	-	-	-	-	-	-	-	-	-	-
FN P90 / 5.7x28 SS190	5	17	35	35	20	4	0	-	-	-	-	-	-	-	-
	-2	-16	-35	-30	-10	-3	0	-	-	-	-	-	-	-	-
Penetration depth [mm]:															
4.6x30	330	(Fragments from copper plating on the projectile found in gelatin between 100mm and 250mm penetration depth.													
		Front half of the projectile was mostly stripped of copper plating.)													
6.5x25 CBJ APDS	600														
9x19 Nammo 7 HP	20	(Penetration of titanium, but stopped in kevlar - only trauma effect.)													
5.7x28 SS190	230														

CBJ Tech – Test protocol

Wound Profiles







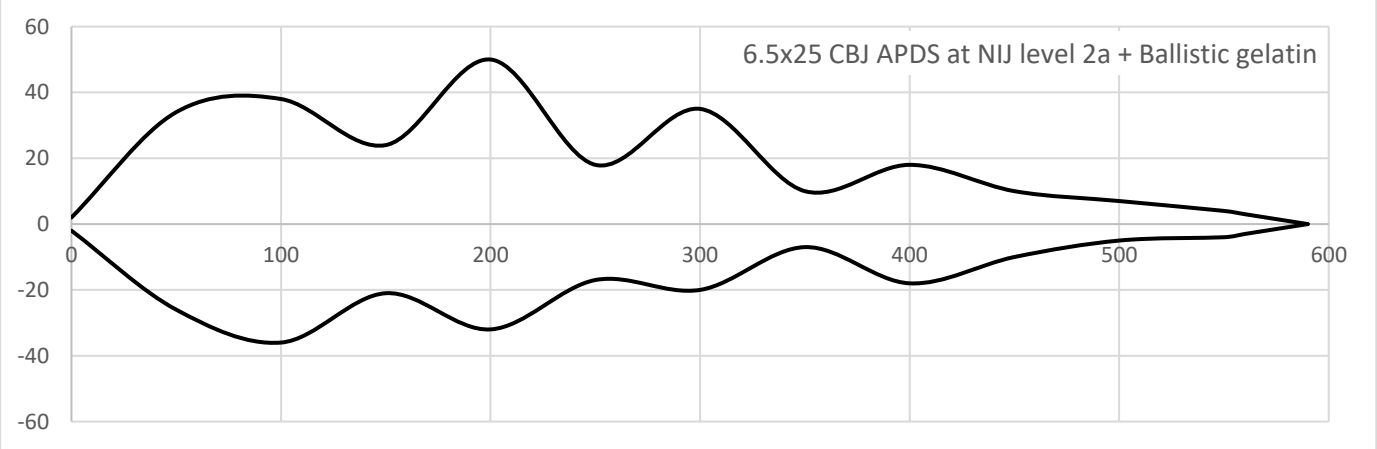
CBJ Tech – Test protocol

Test 4: NIJ level 2a + Ballistic gelatin

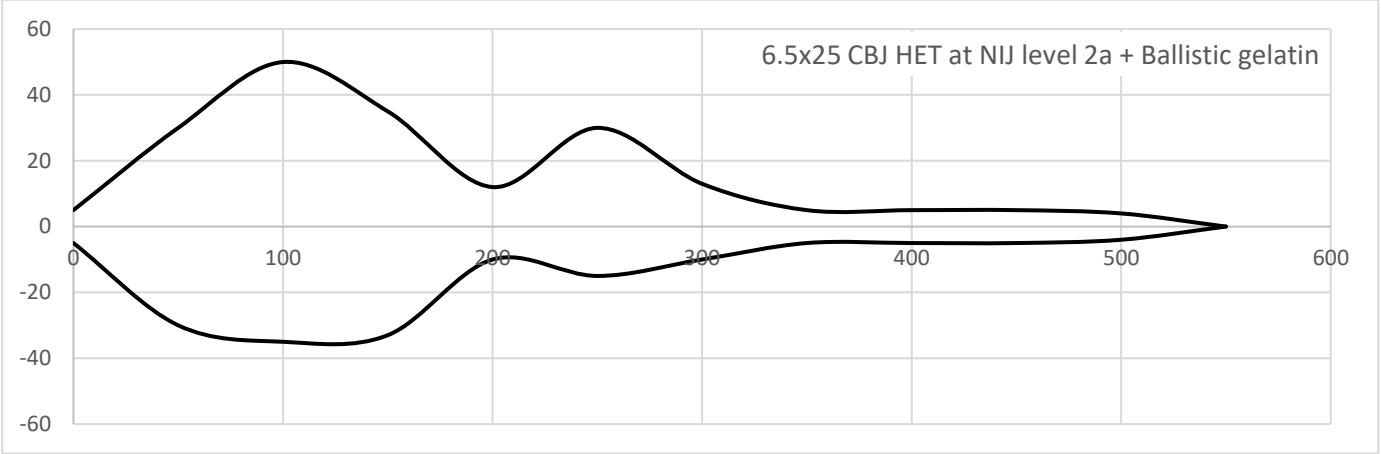
This test was done with a NIJ level 2a body armor panel, placed in front of a block of ballistic gelatin, to evaluate the performance of the respective pistol- and PDW cartridges. The distance to target was 10m.

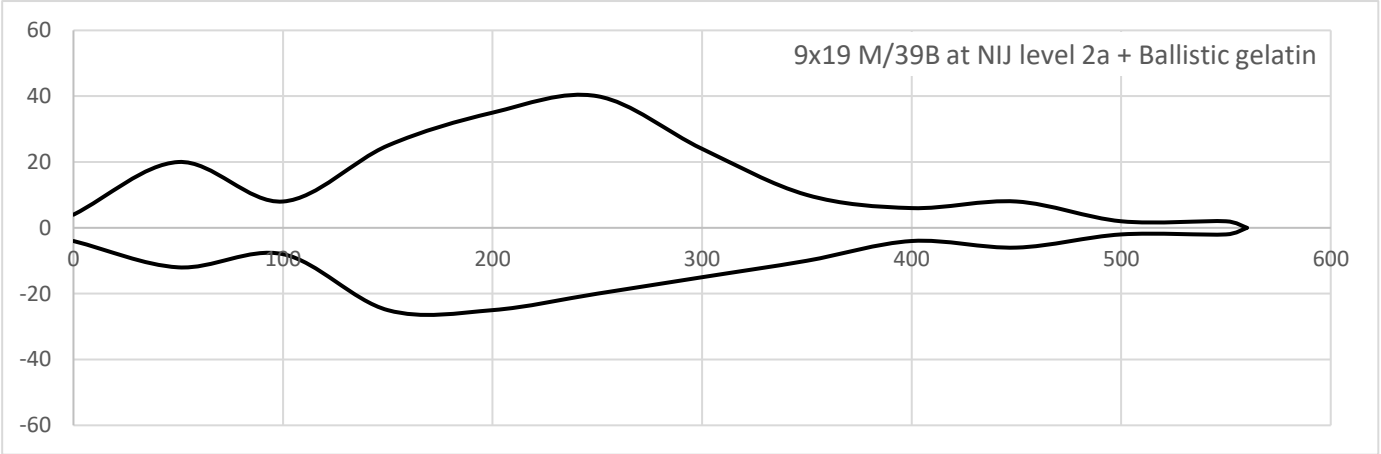
Weapon / Cartridge	**Distance / Cavity size [mm]**													
	0	50	100	150	200	250	300	350	400	450	500	550	560	590
Universal Receiver 120mm	2	34	38	24	50	18	35	10	18	10	7	4	3	0
barrel - 6.5x25 CBJ APDS	-2	-26	-36	-21	-32	-17	-20	-7	-18	-10	-5	-4	-3	0
Universal Receiver 120mm	5	30	50	35	12	30	13	5	5	5	4	0	-	-
barrel - 6.5x25 CBJ HET	-5	-30	-35	-33	-10	-15	-10	-5	-5	-5	-4	0	-	-
Glock 17 / 9x19 - M/39B	4	20	8	25	35	40	24	10	6	8	2	2	0	-
	-4	-12	-8	-25	-25	-20	-15	-10	-4	-6	-2	-2	0	-
Glock 17 / 9x19 - SMP	2	20	35	34	20	10	9	6	3	0	-	-	-	-
6,16g / 95gr	-2	-14	-26	-30	-20	-10	-8	-5	-3	0	-	-	-	-
Penetration depth [mm]:			**V_3** [m/s]											
6.5x25 CBJ Ball	560		739											
6.5x25 CBJ HET	550		750											
9x19 M/39B	560		391											
9x19 SMP	450		419											

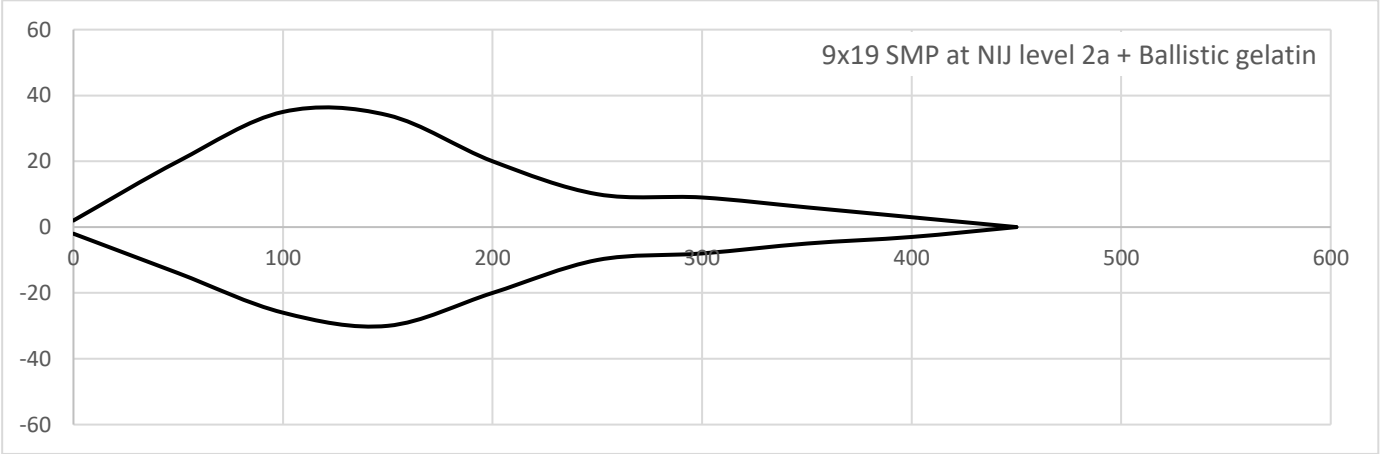
Wound Profiles



CBJ Tech – Test protocol







CBJ Tech – Test protocol

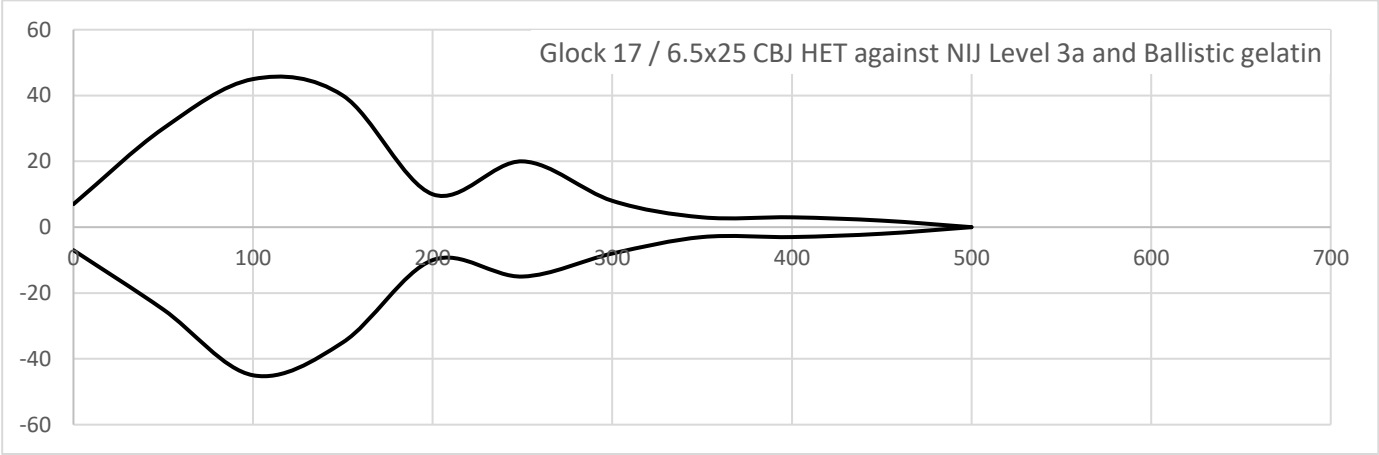
Test 5: NIJ level 3a + Ballistic gelatin

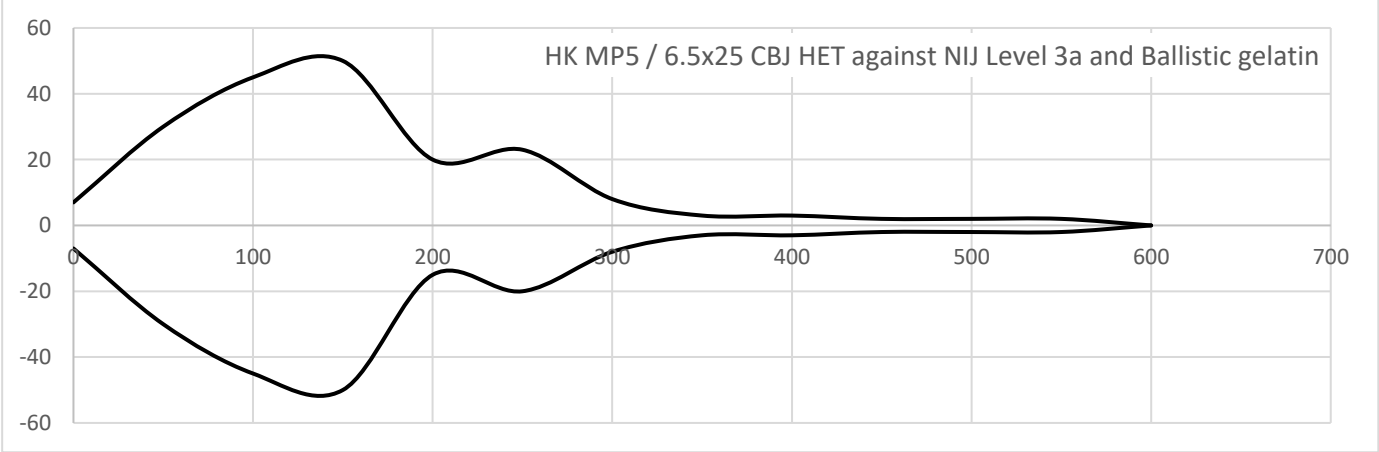
This test was done with a NIJ level 3a body armor panel, made of 30 layers of Kevlar, placed in front of a block of ballistic gelatin, to evaluate the performance of the respective pistol- and PDW cartridges. The distance to target was 10m.

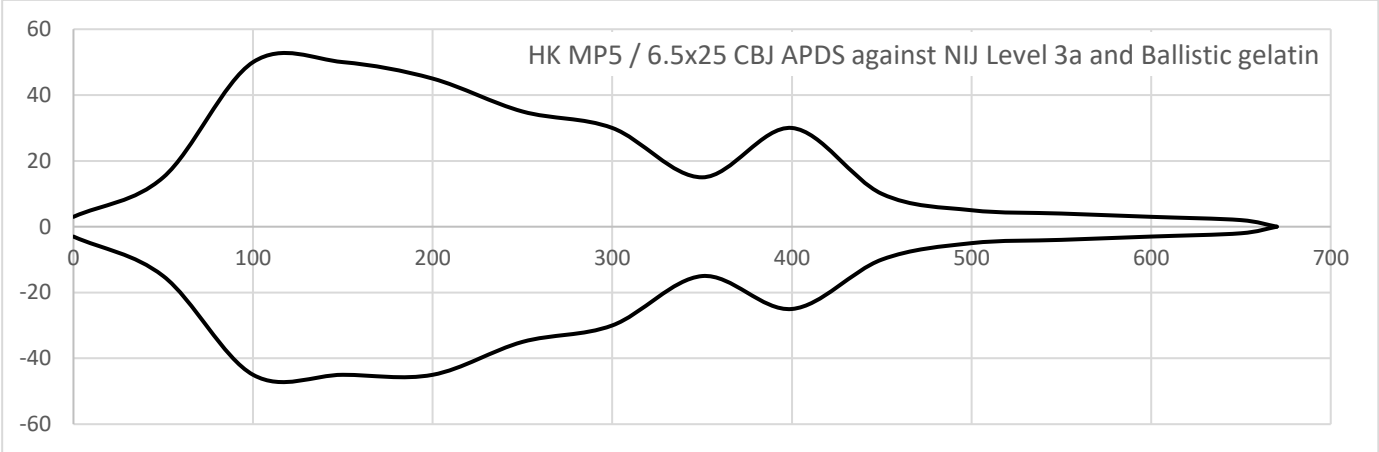
Weapon / Cartridge	**Distance / Cavity size [mm]**														
	0	50	100	150	200	250	300	350	400	450	500	550	600	650	670
Glock 17 / 6.5x25 CBJ HET	7	30	45	40	10	20	8	3	3	2	0				
	-7	-25	-45	-35	-10	-15	-8	-3	-3	-2	0				
HK MP5 / 6.5x25 CBJ HET	7	30	45	50	20	23	8	3	3	2	2	2	0		
	-7	-30	-45	-50	-15	-20	-8	-3	-3	-2	-2	-2	0		
HK MP5 / 6.5x25 CBJ APDS	3	15	50	50	45	35	30	15	30	10	5	4	3	2	0
	-3	-15	-45	-45	-45	-35	-30	-15	-25	-10	-5	-4	-3	-2	0
Glock 17 / 9x19 FMJ	No Penetration														
Penetration depth [mm]:															
Glock 17 / 6.5x25 CBJ HET	500														
HK MP5 / 6.5x25 CBJ HET	600														
HK MP5 / 6.5x25 APDS	670														
Glock 17 / 9x19mm FMJ	No Penetration														

CBJ Tech – Test protocol

Wound Profiles







CBJ Tech – Test protocol

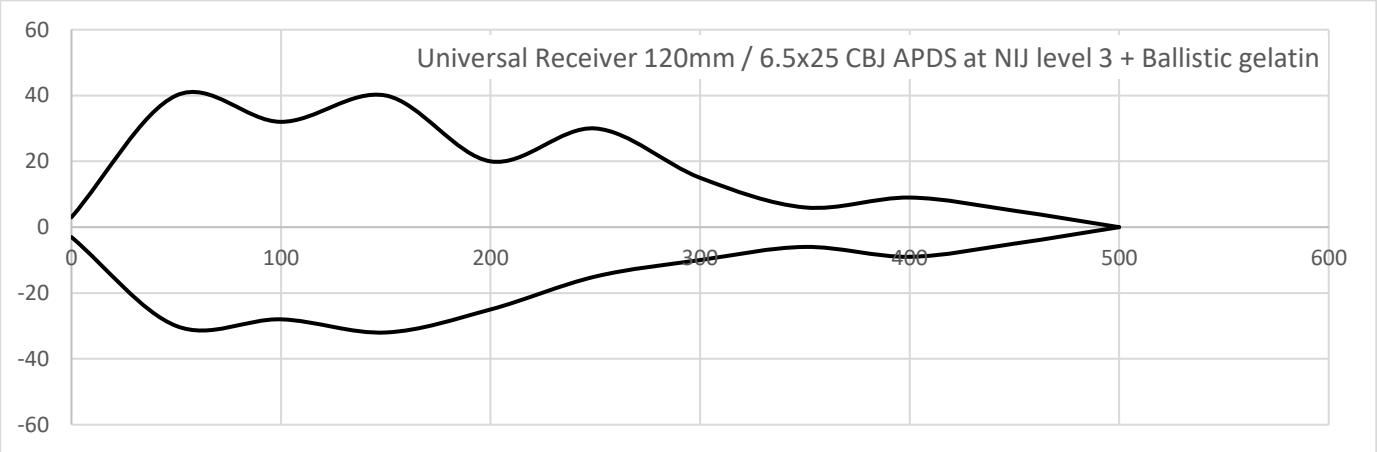
Test 6: NIJ level 3 + Ballistic gelatin

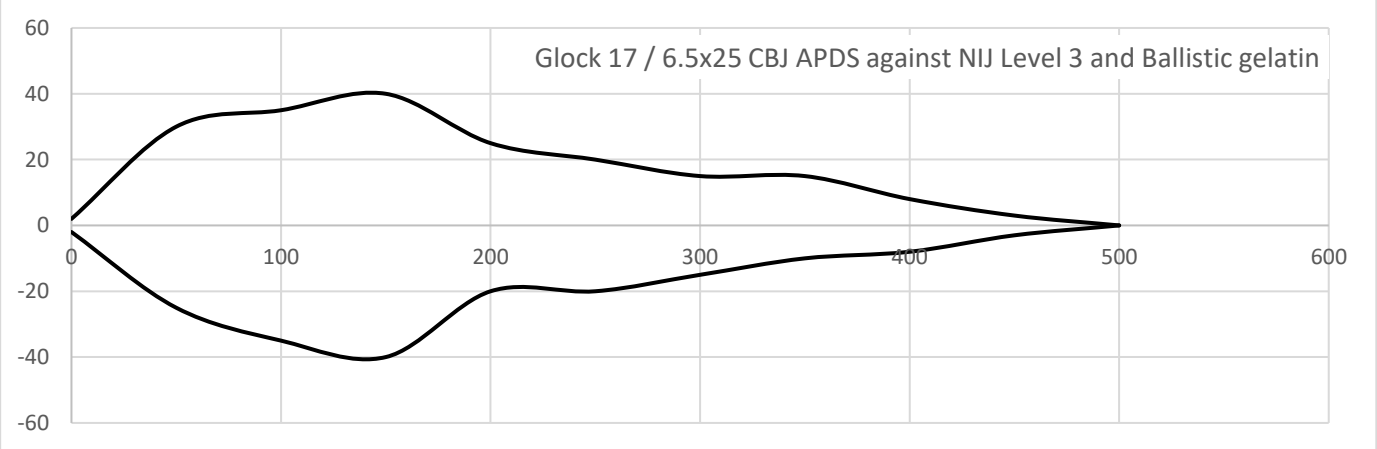
This test was done with an 18mm thick NIJ level 3 body armor panel, made of Kevlar and Polyethene, placed in front of a block of ballistic gelatin, to evaluate the performance of the respective pistol- and PDW cartridges. The distance to target was 10m.

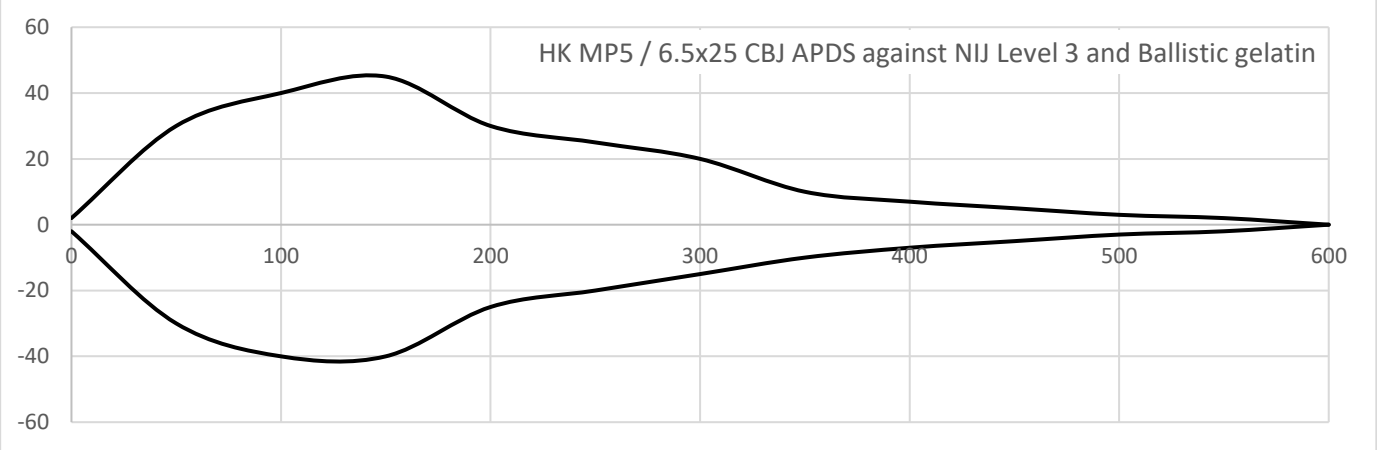
Weapon / Cartridge	**Distance / Cavity size [mm]**												
	0	50	100	150	200	250	300	350	400	450	500	550	600
Universal Receiver 120mm barrel	3	40	32	40	20	30	15	6	9	5	0		
6.5x25 CBJ APDS	-3	-30	-28	-32	-25	-15	-10	-6	-9	-5	0		
Universal Receiver 120mm barrel													
6.5x25 CBJ HET	No Penetration												
Glock 17 / 6.5x25 CBJ APDS	2	30	35	40	25	20	15	15	8	3	0		
	-2	-25	-35	-40	-20	-20	-15	-10	-8	-3	0		
HK MP5 / 6.5x25 CBJ APDS	2	30	40	45	30	25	20	10	7	5	3	2	0
	-2	-30	-40	-40	-25	-20	-15	-10	-7	-5	-3	-2	0
HK MP5 / 6.5x25 CBJ HET	No Penetration												
Glock 17 / 9x19 - M/39B	No Penetration												
HK MP7 / 4.6x30	No Penetration												
FN P90 / 5.7x28 SS190	No Penetration												
AK47 / 7.62x39 FMJ	No Penetration												
Penetration depth [mm]:													
6.5x25 CBJ APDS	500	From Pistol and Universal Receiver						600	From HK MP5				
6.5x25 CBJ HET	No Penetration												
9x19mm FMJ (M/39B)	No Penetration												
HK MP7 / 4.6x30	No Penetration												
FN P90 / 5.7x28 SS190	No Penetration												

CBJ Tech – Test protocol

Wound Profiles







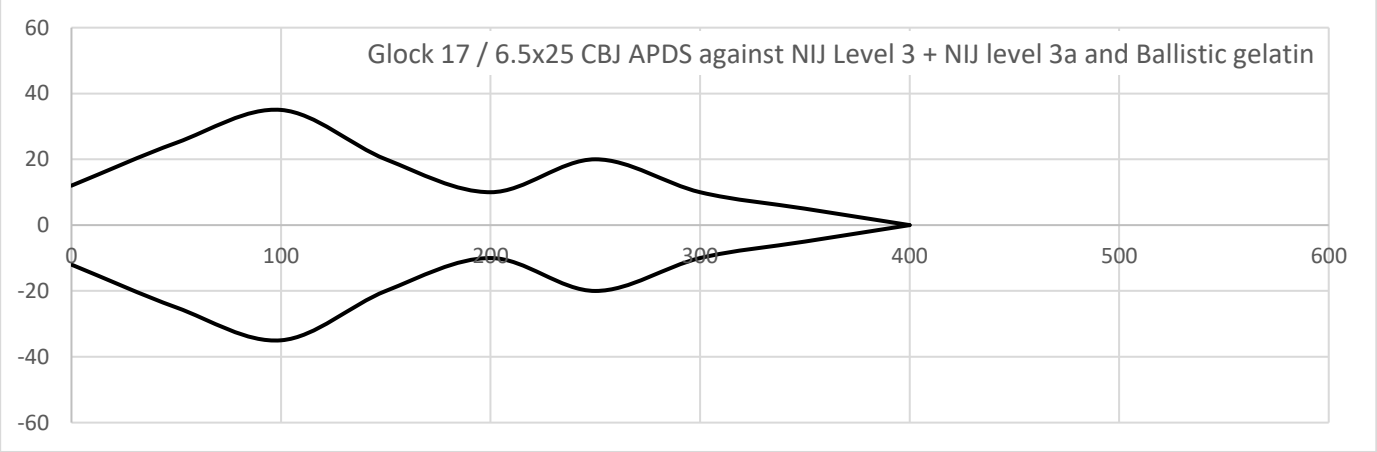
CBJ Tech – Test protocol

Test 7: NIJ level 3 + NIJ level 3a + Ballistic gelatin

This test was done with an 18mm thick NIJ level 3 body armor panel, made of Kevlar and Polyethene, combined with a NIJ level 3a body armor panel, made of 30 layers of Kevlar, placed if front of a block of ballistic gelatin, to evaluate the performance of the respective pistol- and PDW cartridges. The distance to target was 10m.

Weapon / Cartridge	**Distance / Cavity size [mm]**														
	0	50	100	150	200	250	300	350	400	450	500	550	600	650	670
Glock 17 / 6.5x25 CBJ APDS	12	25	35	20	10	20	10	5	0						
	-12	-25	-35	-20	-10	-20	-10	-5	0						
Penetration depth [mm]:															
Glock 17 / 6.5x25 CBJ APDS	400														

Wound Profile



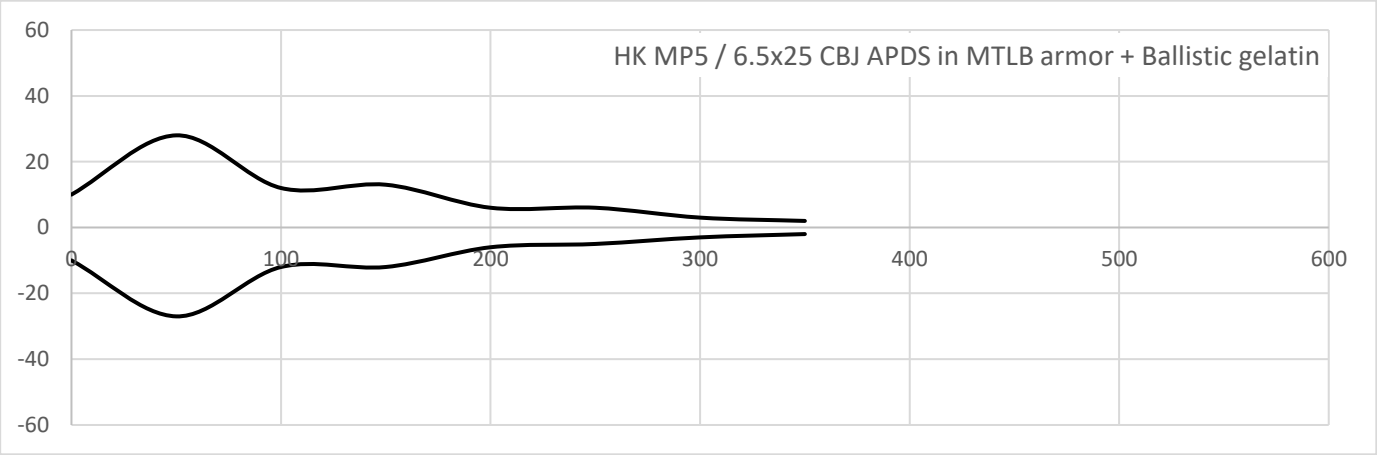
CBJ Tech – Test protocol

Test 8: MTLB armor + Ballistic gelatin

This test was done with ballistic gelatin combined with an armor plate taken from a Russian MTLB armored personnel carrier. The armor is 7mm thick and has a hardness of 450 HB. 6.5x25 CBJ APDS was shot from an HK MP5 fitted with a standard length 6.5x25 CBJ barrel, at 10m range. All of the other cartridges tested in this report has previously been tested against this armor panel and constantly fails to penetrate it, so they were not tested here.

Weapon / Cartridge	**Distance / Cavity size [mm]**							
	0	50	100	150	200	250	300	350
HK MP5 / 6.5x25 CBJ APDS	10	28	12	13	6	6	3	2
	-10	-27	-12	-12	-6	-5	-3	-2
Penetration depth [mm]:								
6.5x25 CBJ APDS	350+	The projectile penetrated the entire 350mm deep block of gelatin. Fragments from the armor were found at 60mm, 90mm and at 150mm depth in the gelatin.						

Wound Profile



CBJ Tech – Test protocol

Summary

From a military perspective, it is always preferable to have a good penetration capability as well as good incapacitating capability in small arms ammunition. Oftentimes there are different types of barriers between the muzzle and the intended target, and a good penetration capability ensures that the projectile will reach the target and deliver energy.

In every test, the 6.5x25 CBJ cartridge outperforms the competitors in regards to penetration depth, while still creating a similar or larger temporary cavity in the first 300mm of ballistic gelatin. This is especially true if there is a more potent barrier like the body armor panels used in some of the tests. In the tests with the NIJ level 3 body armor panels, only the 6.5x25 CBJ could penetrate them. The same is also true for the armor plate taken from the Russian MT-LB armored personnel carrier.