

The *NEW* Body Armor Standard from NIJ: The FOP Perspective

The advent of body armor and ongoing development of bullet-resistant technology has saved the lives of thousands of law enforcement officers. The National Institute of Justice (NIJ) has been at the forefront in developing minimum standards and testing procedures to evaluate the performance of this critical, life-saving equipment.

The Ballistic Resistance of Body Armor *NIJ Standard-0101.06*, released in July of 2008, is the latest NIJ Standard concerning the ballistic resistance of body armor; it replaces *NIJ Standard-0101.04*, released in the year 2000. The older standard did not include an evaluation of the body armor after a period of wear and, in 2003, the FOP learned that a police officer in Forest Hills, Pennsylvania was seriously wounded because his body armor failed to protect him from a bullet that the vest was rated to stop. It was the first verifiable incident in which soft body armor failed to prevent penetration from a bullet it was designed to defeat.

The FOP brought this information to the attention of then-U.S. Attorney General John D. Ashcroft, who ordered the NIJ to investigate this failure and develop a new standard so that the men and women in law enforcement would be able to have full confidence in their body armor once again. The investigations soon demonstrated that the use of a material called Zylon® contributed to the armor's failure, and soft body armor manufactured from this substance was excluded from Federal funding programs designed to help agencies purchase and upgrade their armor. In addition, a new interim standard was issued to better reflect the performance of body armor after a period of wear.

The *0101.06* standard is a more refined and comprehensive version of the interim standard and draws upon the considerable research conducted by the NIJ over the last five years. It establishes new and updated minimum performance requirements and test methods for the ballistic resistance of personal body armor designed to protect the torso against gunfire. It is limited to ballistic resistance only and does not address resistance from knives or other sharply pointed objects. This paper will focus on the new body armor standard and highlight changes from *NIJ Standard-0101.04*.

The new standard revises body armor classifications and testing methods by specifying the minimum performance requirements that equipment must meet to satisfy the requirements of criminal justice agencies and the methods that shall be used to test this performance. This standard is used by the NIJ Voluntary Compliance Testing Program (CTP) to determine which body armor models meet the minimum performance requirements for inclusion on the NIJ Compliant Products List. This list is made available to law enforcement agencies nationwide and internationally to provide them with information as to which equipment is best suited to protect their law enforcement officers.

The most significant change in *NIJ Standard-0101.06* is that body armor will now be tested after being exposed to heat, humidity, and general wear and tear. Also, for the first time, used or "conditioned" armor will be tested as well. The new standard is more rigorous in the area of Perforation and Backface Signature (P-BFS) Testing. The velocity of rounds fired in this test has been increased. Further, Type I body armor which is the lowest level of ballistic protection, will no longer be tested or listed.

Body Armor Classification

The new standard classifies five types of body armor (IIA, II, IIIA, III, IV), ranking the types based on ballistic performance. Type IIA, II and IIIA are generally used for protection from handguns and can be concealed, while types III and IV can be used for protection from rifles and in tactical situations; types III and IV can either be hard or flexible. There is also a "special type" where a purchaser having a special

need for a level of protection not covered by type IIA, II, IIIA, III, IV could create their own test requirements.

A major change from the 2000 standard is that Type I will no longer be tested and placed on the NIJ Compliant Products List, because of the unfortunate capability of criminals to obtain higher powered firearms. Another significant change is that Types IIA, II and IIIA will be sub-classified into "new" and "conditioned," with less stringent requirements for conditioned or used armor. New and conditioned Types III and IV, hard or flexible, will have the same requirements. Another change is that Types IIA, II, and IIIA will now be tested in small and large sizes. This is important because larger sizes have shown to be less reliable than smaller sizes in the past; the previous standard only tested medium sizes.

Testing and Requirements

Before testing, the armor will be inspected for various defects, such as wrinkles, fabric tears, and cracks; uniformity in construction is also necessary. Also, after every test each sample's ballistic components will be inspected immediately to verify their construction details (layers, weave, stitching, material, etc.).

Body armor will be subjected to two tests, the Perforation and Backface Signature Test (P-BFS), and the Ballistic Limit (BL) Determination Test. For both tests, Types IIA, II, and IIIA are subjected to 2 rounds, because they are tested with two different bullets. Both new and conditioned armor are tested.

The most significant change concerning the new standard is testing the effects of heat, moisture, and mechanical wear. Every new sample of armor will go through a standardized conditioning process. This new protocol will not predict the service life of the armor or the precise effects of usage, but this new conditioning of the armor will help achieve a critical goal—that all armor materials should be robust enough to handle different wear and climate conditions. For example, armor is normally stored in the officer's vehicle, and in the summer the temperature of a closed vehicle can exceed 140 degrees. This, along with a few years of use, can greatly affect the effectiveness of body armor.

Another change is that manufacturer and model of all test bullets will be standardized, reducing the variability in the test results.

Perforation and Backface Signature (P-BFS) Test

"The P-BFS test requires the armor to demonstrate consistent ballistic resistance to both perforation and excessive blunt force trauma."- (The term "complete penetration" has been replaced by the term "perforation" for this standard. Perforation is any impact that creates a hole passing through the armor). Behind the armor is clay backing material. The greatest extent of indentation in the backing material caused by a non-perforating impact on the armor is referred to as the BFS Measurement. The BFS measurement or indentation of the backing clay does not represent an exact simulation of the effects that a particular round will have on an officer, it is just a standardized measurement.

During testing each vest or jacket will be shot six times with the first three being near the edges, and the second three close together, unless the armor does not have uniform thickness; in that case the later three shots will be aimed at the weakest spots in the armor. Also, the distance of the shot to the edge of the vest or jacket has been decreased from the previous standard. This will increase the area of reliable coverage and reduce injuries and fatalities due to shots impacting close to edges of the vest and jackets.

The maximum BFS measurement of 44mm for all types of armor is the same maximum from the 2000 standard. Generally speaking, armor test velocity is now higher than the new standard.

Bullet and test Velocity for P-BFS test

Armor	Bullet	Test Velocity	Test Velocity	Test Velocity
IIA	9mm FMJ RN	373	355	341
IIA	40 S&W FMJ	352	325	322
II	9mm FMJ RN	398	379	367
II	.357 Magnum JSP	436	408	436
IIIA	.357Sig FMJ RN	448	430	used 9mm
IIIA	.44 magnum SJHP	436	408	436
III	7.62mm NATO FMJ	847	847	838
IV	.30 Caliber M2 AP	878	878	869

As the figure above shows, all the test velocities for the new armor are the same or higher for the new standard. For types III and IV the new standard is higher. As far as conditioned armor is concerned, the new standard has a higher test velocity for IIA and II (with 9mm) than the 2000 standard's test velocity for new armor. The 2000 standard for new armor was higher than the new standard for conditioned armor for II (.357mag) and III A (.44mag). For IIIA, the new standard uses .357 sig FMJ FN for the first round of bullets instead of 9mm. This change will create a higher minimum and increase the effectiveness of the armor.

Auxiliary Ballistic panels (Groin and coccyx Protectors and Removable Side Protection) will also be tested. The requirements are more rigorous than they were in the 2000 standard.

Ballistic Limit (BL) Determination Test

"The Baseline Ballistic Limit is the experimentally derived ballistic limit of an armor model when new." - In the 2000 standard there were no performance requirements and the results were merely reported as a V_{50} . The V_{50} is the velocity at which a projectile is expected to be stopped by the armor 50 % of the time. The new requirement would set the lowest perforation velocity for an armor type, which must be 9m/s higher than P BFS test velocity. For example, the test velocity for a type II shot with a 9mm is 398 m/s. In the BL test Type II armor must be able to withstand a 9mm at a velocity of 407m/s (398m/s+9m/s) without perforation.

The new standard has also made changes to estimate a more accurate V_{50} . Each type of armor will be shot a minimal amount of times, with a certain number of ballistic panels. (Types IIA, II, and IIA with 2 rounds of 120 shots each, Type III with 24 shots and Type IV with 12 shots) This is a great improvement from the 2000 standard; the amount of rounds shot into each armor has been significantly increased for all types.

Conclusion

Ballistic Resistance of Body Armor NIJ Standard-0101.06 will greatly increase the safety of our nation's law enforcement officers. First, removing Type I armor from the standard is critical, as the advancement in the firearms used by criminals have made it less effective. The enhanced conditioning of the armor to gauge the effects of heat, moisture and wear is not perfect, but a step in the right direction, and perhaps the best approximation for determining its long term effectiveness. The testing of used armor is also important for achieving this goal. The increased test velocities for the P-BFS testing and new performance requirements for BL testing help ensure officers in the reliability of their armor. Overall, this new standard is a great improvement upon the old standard and will help save the lives of officers who are shot in the line of duty.

References

- National Institute of Justice. NIJ *Standard–0101.04, Ballistic Resistance of Police Body Armor*, 2000.
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- Section 7.1
 - Section 3.13