Designation: E3062 – 16ε1

Standard Specification for Indoor Ballistic Test Ranges for Small Arms and Fragmentation Testing of Ballistic-resistant Items[1]

This standard is issued under the fixed designation E3062; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ε) indicates an editorial change since the last revision or reapproval.

ε[1] NOTE—Editorially corrected 3.2.1 in December 2016.

1. Scope

1.1 This standard specifies indoor ballistic test range requirements for small arms and fragmentation testing of the following ballistic-resistant items: soft body armor, hard armor plates, body armor accessories, shields, and helmets. The specification includes requirements for range geometry (for example, dimensions, alignment, spacing), range conditions (for example, temperature, humidity, lighting), test equipment (for example, receiver, mounting, test barrels, backing assembly mounting), instrumentation (for example, light screens, high speed cameras, radar), and measurement procedures (for example, projectile velocity, yaw).

1.2 The purpose of this standard is to specify critical test range parameters in order to achieve consistency/repeatability among test ranges.

1.3 This specification is not applicable for "contact" shots taken on the test item (that is, the muzzle rests on the strike face of the test item).

1.4 *Units*—The values stated in inch-pound units are to be regarded as standard. The values given in parentheses are mathematical conversions to SI units that are provided for information only and are not to be considered standard.

1.5 *This standard does not address environmental concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate practices and determine the applicability of regulatory requirements prior to use.*

1.6 *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.*

2. Referenced Documents

2.1 *ASTM Standards:*[2]
E3005 Terminology for Body Armor

2.2 *SAAMI Standard:*[3]
SAAMI Glossary of Industry Terms

3. Terminology

3.1 For terms not defined in this specification, the following definitions of Terminology E3005 apply: angle of incidence, backing assembly, backing material, backing fixture, body armor, hard armor, plates, soft body armor, stop, strike face, test item, and yaw.

3.2 *Definitions of Terms Specific to This Standard:*

3.2.1 *test item mounting system, n*—an assembly consisting of a test stand and the test item fixture, backing assembly, witness panel, or any combination thereof. The system allows rotation of the test item around one or more axes and allows translation of the test item.

3.2.2 *test stand, n*—a rigid or massive component of the test item mounting system that supports other components.

3.2.3 *universal receiver, n*—a heavy duty mechanical device into which chambered barrels are secured for testing ammunition (SAAMI).

4. Significance and Use

4.1 U.S. Department of Defense and U.S. Department of Justice standards for assessing the performance of ballistic-resistant personal protective equipment require the use of properly configured indoor test ranges. This specification is one of several standards that will help to ensure that testing results between test ranges are comparable.

[1] This specification is under the jurisdiction of ASTM Committee E54 on Homeland Security Applications and is the direct responsibility of Subcommittee E54.04 on Personal Protective Equipment (PPE).

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[2] For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

[3] Available from Sporting Arms and Ammunition Manufacturers' Institute (SAAMI), 11 Mile Hill Rd, Newtown, CT 06470, www.saami.org.

4.2 This specification may be used by private-sector and government laboratories, manufacturers, research and development organizations, and others assessing the ballistic resistance of personal protective equipment.

4.3 It is intended that this specification be referenced by other standards, specifications, or test methods, or combinations thereof.

5. Minimum Room Dimensions

5.1 The test range dimensions should be sufficient to accommodate the required equipment and spacing between that equipment and the room walls and ceiling so personnel can safely perform testing without obstruction.

6. Range Environmental Conditions

6.1 The relative humidity shall be 50 ± 20 %.

6.2 The controlled ambient temperature shall be 68 ± 10°F (20 ± 5.5°C).

6.3 General lighting on the range should provide adequate light levels to enable personnel to perform assigned duties. Local lighting to supplement general lighting, if needed, should be available to provide better visibility for tasks associated with measurements and instrument readings.

NOTE 1—Local lighting may be a flashlight, headlamp, or other light source that does not emit enough heat to affect the test results.

7. Projectile Firing System

7.1 The projectile firing system shall be one of the following:

7.1.1 Receiver and test barrel.

7.1.2 Firearm.

NOTE 2—Use of a firearm is not the preferred method.

7.2 All components of the projectile firing system shall be mounted.

NOTE 3—The intent of mounting the projectile firing system is to achieve accurate and repeatable performance.

8. Measurement Systems

8.1 *Projectile Velocity Measurement System:*

8.1.1 The system shall maintain position and alignment during testing.

8.1.2 The system shall be appropriate for the projectile and the velocities being measured.

8.1.3 An independent method for verifying the accuracy of the system shall be available.

8.1.4 The projectile velocity should be determined using at least two electronically independent sets of instrumentation. If two electronically independent sets of instrumentation are not used, the reason and the type of instrumentation used shall be documented.

8.1.4.1 For each projectile firing, the two independent sets of instrumentation shall provide individual velocity measurements within 10 ft/s (3 m/s) of each other, with the following considerations.

(1) If the screen pairs do not agree within 10 ft/s (3 m/s) and either screen pair yields a reading that is not within 75 % of the intended test threat velocity, that value should be discarded, and the other reading shall be recorded as the velocity measurement. All occurrences of this condition shall be documented.

(2) If the screen pairs do not agree within 10 ft/s (3 m/s) and both screen pairs yield a reading that is within 75 % of the intended test threat velocity, the test result is considered invalid, and the test shall be redone. All occurrences of this condition shall be documented.

(3) If there is reasonable doubt that the screen pairs are reading correctly, the test result may be considered invalid, and the test shall be redone. All occurrences of this condition shall be documented.

NOTE 4—Appendix X1 provides examples to aid in understanding these considerations.

NOTE 5—This standard does not address velocity loss (that is, drag) from the measurement location to the test item. Other standards, specifications, or test methods can address velocity loss.

8.1.5 Undesirable influences on the velocity measurement system shall be mitigated.

NOTE 6—Undesirable influences include, but are not necessarily limited to, shock waves, sound waves, light, ejected propellant, sabots, and other debris.

8.2 *Projectile Yaw Measurement System:*

8.2.1 The test laboratory shall provide a method for verifying yaw.

NOTE 7—Yaw requirements (for example, maximum allowable yaw) and details necessary for making yaw measurements (for example, location of yaw measurement) are specified in other standards, specifications, or test methods, or combinations thereof.

9. Spacing and Set Up of Test Equipment

9.1 The test equipment shall be set up as shown in Fig. 1 with spacing and additional requirements as described in Table 1 and the remainder of this section.

9.1.1 The test equipment shall be set up as though the shot were to be taken at an angle of incidence of 0°; the test equipment shall not be moved, except as it pertains to translating for aiming and rotating to accommodate obliquity or angle of incidence requirements.

9.2 The distance from muzzle to test item reference plane (D1 in Fig. 1) may be adjusted to minimize yaw or blast effects. The reason for the adjustment and the distance used shall be documented. The distance from the location of velocity measurement to the test item reference plane (D2 in Fig. 1) shall not be adjusted.

NOTE 8—The test item reference plane will be specified in other standards, specifications, or test methods because the test item's reference plane differs depending on the test item.

9.3 If radar, high-speed video, or X-ray is used for velocity measurement, the velocity reported shall be either the velocity measured at the location given in Table 1 or the velocity measured at the test item as specified in other standards, specifications, or test methods.

9.4 If light screens are used for velocity measurement, the requirements below shall be met.

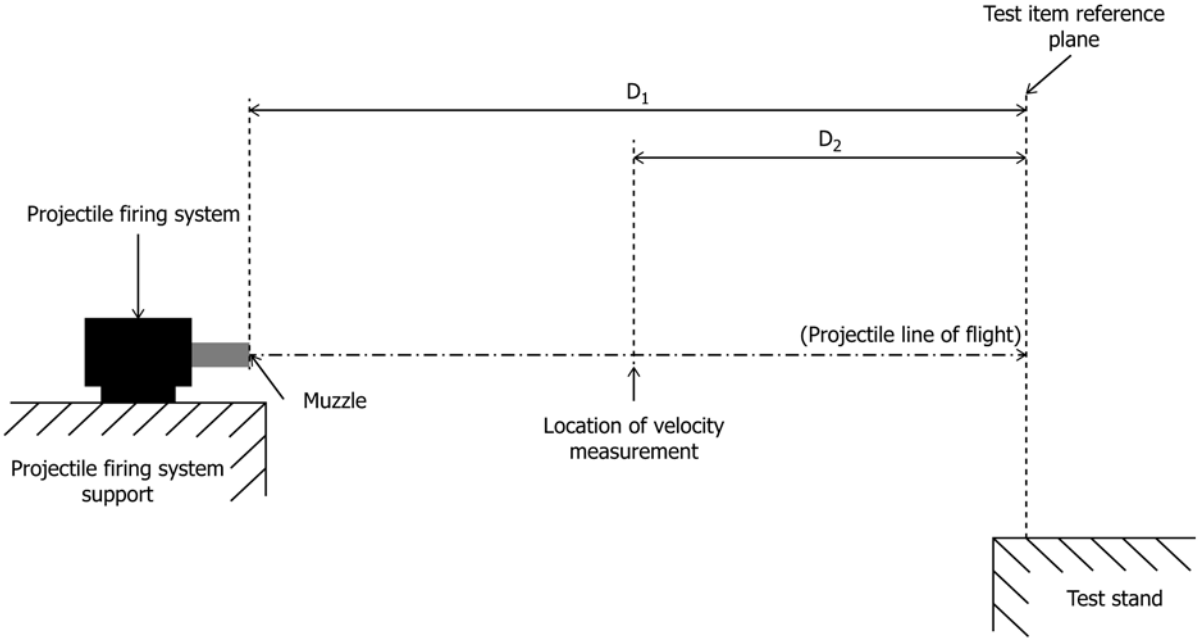

FIG. 1 Test Range Setup and Relative Positioning

TABLE 1 Test Range Distances Depending on Test Threat

Test Threat	Distances
1. Rifle and Fragment Simulators[A] greater than 64 grain.	•D_1: muzzle to test item reference plane = nominally 25 ft (7.6 m) •D_2: location of velocity measurement to test item reference plane = 12.5 ft ± 1.0 in. (3.7 m ± 2.5 cm)
2. Handgun and Fragment Simulators 16 grain to 64 grain.	•D_1: muzzle to test item reference plane = nominally 15 ft (4.6 m) •D_2: location of velocity measurement to test item reference plane = 7.5 ft ± 1.0 in. (2.3 m ± 2.5 cm)
3. Fragment Simulators less than 16 grain.	•D_1: muzzle to test item reference plane = nominally 10 ft (3 m) •D_2: location of velocity measurement to test item reference plane = 3 ft ± 1.0 in. (0.9 m ± 2.5 cm)

[A]Fragment simulators include (*1*) right circular cylinders (RCCs) and (*2*) fragment simulating projectiles (FSPs).

9.4.1 The light screens shall be positioned as shown in Fig. 2.

9.4.2 The inner screens shall be paired together, and the outer screens shall be paired together.

9.4.3 The light screen pairs shall be parallel to each other and perpendicular to the projectile firing system barrel.

9.4.4 The distance from the last light screen to the test item reference plane shall be no greater than 5 ft (1.5 m).

9.4.5 The light screens shall be fastened together to prevent inadvertent changes in spacing.

NOTE 9—The spacing between the light screens may be adjusted to meet velocity measurement requirements.

10. Test Item Mounting System

10.1 The test stand shall maintain position during the test event.

NOTE 10—Examples include, but are not limited to, test stands that are affixed to the building structure or those that have sufficient mass.

NOTE 11—This specification does not describe any specific fixture, backing assembly, or witness panel for the test item.

10.2 The test item mounting system shall permit the test item and any backing material or witness panel to be shifted vertically and laterally to allow ballistic impacts at various locations on the test item.

10.3 The test item mounting system shall permit the test item and any backing material or witness panel to be rotated to allow for shots impacting the test item at angles other than 0°.

10.4 A backstop or bullet trap should be positioned at a distance behind the test item location.

11. Keywords

11.1 ballistic test range; ballistic test range configuration; projectile velocity; small arms

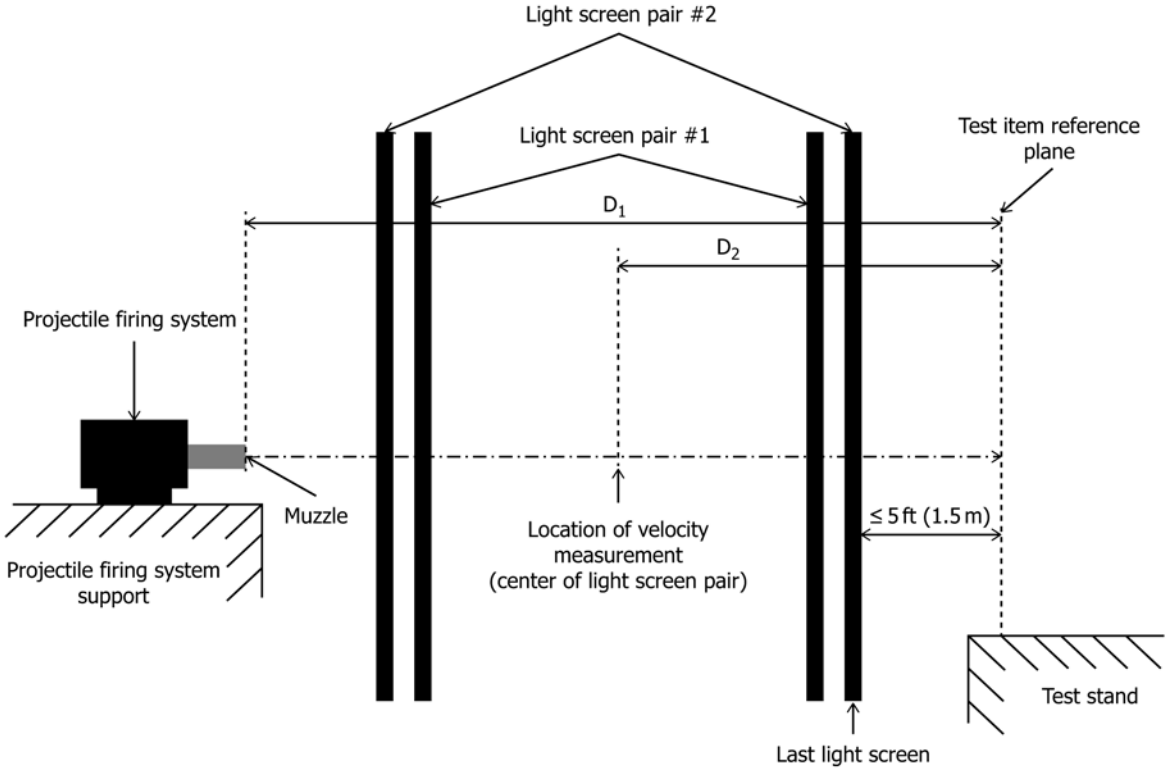

FIG. 2 Test Range Setup with Light Screens

APPENDIX

(Nonmandatory Information)

X1. HELPFUL INFORMATION RELATED TO THE CONSIDERATIONS IN 8.1.4.1

X1.1 The exception allowed in 8.1.4.1 comes into play when one of the two light screen pairs does not yield a correct result (for example, false trigger, failure to trigger, or pre-trigger). This occurrence is more likely to happen for some test threats: (*1*) Rifle, handgun: This is a rare occurrence. (*2*) Fragments, shotgun: This can occur more often.

X1.2 75 % of the intended velocity was set as the decision point, and the following examples are provided to aid understanding. The examples use an intended velocity of 1000 ft/s:

- Example 1: Screen pair 1 = 1000 ft/s, and Screen pair 2 = 249 ft/s: This shot is considered to be valid; the screen pair 1 result is accepted and documented; the screen pair 2 result is discarded.
- Example 2: Screen pair 1 = 1000 ft/s, and Screen pair 2 = 250 ft/s: This shot is considered to be invalid; both screen pair results are rejected and documented.
- Example 3: Screen pair 1 = 1000 ft/s, and Screen pair 2 = 251 ft/s: This shot is considered to be invalid; both screen pair results are rejected and documented.