



Designation: F589 – 23

# Standard Consumer Safety Specification for Non-Powder Guns<sup>1</sup>

This standard is issued under the fixed designation F589; 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 reappraisal. A superscript epsilon ( $\epsilon$ ) indicates an editorial change since the last revision or reappraisal.

## INTRODUCTION

This consumer safety specification is intended to address the primary causes of injuries involving non-powder guns and projectiles. Information concerning these injuries was obtained from data collected by the Consumer Product Safety Commission, hereinafter referred to as the Commission, consumer sounding boards, and the manufacturers' knowledge of the product and experience with consumer injuries.

The subcommittee regularly conducts comprehensive reviews from data provided by the Commission and has determined that carelessness, intentional misuse, or lack of adequate adult supervision, or a combination thereof, were factors in the shooting injuries examined.

To perform as intended, a non-powder gun requires a level of power which, if misused, can cause serious injury. This consumer safety specification is intended to reduce the hazards associated with non-powder gun use. This specification cannot control careless use or eliminate all hazards of misuse, but does provide for warnings of specific hazards and instructions for proper handling, use, and storage. Terminology is standardized in this specification, so that conforming products will be identified in the same manner, and critical dimensions are standardized to assure safe interchangeability of projectiles and propellants in all conforming non-powder guns. Product performance hazards are identified and requirements are established to minimize these hazards.

This consumer safety specification is written within the current state-of-the-art of non-powder gun technology. The intent is to revise this consumer safety specification whenever substantive information becomes available which justifies revising existing requirements or adding new requirements.

## 1. Scope

1.1 This consumer safety specification covers non-powder guns, commonly referred to as BB guns, air guns, and pellet guns, which propel a projectile by means of energy released by compressed air, compressed gas, mechanical spring action, or a combination thereof, and is to be used in conjunction with Specification F590.

1.2 Special-purpose match precision and adult guns, as defined in 3.1 and classified in 8.1 and 8.2, are exempt from the performance requirements for trigger mechanisms (see 4.3), safety mechanisms (see 4.4), and drop tests (see 4.5).

1.3 Special-purpose training guns, as defined in 3.1 and classified in 8.3, are exempt from the performance requirements for the safety mechanism (see 4.4).

<sup>1</sup> This consumer safety specification is under the jurisdiction of ASTM Committee F15 on Consumer Products and is the direct responsibility of Subcommittee F15.06 on Safety Standards for Non-Powder Gun Products.

Current edition approved Jan. 1, 2023. Published January 2023. Originally approved in 1978. Last previous edition approved in 2017 as F589 – 17. DOI: 10.1520/F0589-23.

1.4 *Limitations*—This consumer safety specification does not cover the following categories of gun products: custom-made non-powder guns (see 3.1.2.6); or replica guns (see 3.1.2.15); tranquilizer dart guns; toy products such as rubber-band guns, cork guns, pop guns, rubber-tip dart guns, or pea and bean shooters; other recreational-type guns such as blow guns, spear guns, catapult guns (also identified as sling shots), bows, crossbows, paintball markers, air soft or soft air guns, or carbide guns; nonrecreational guns such as those used by law enforcement, scientific, or military agencies; nor industrial and consumer tools such as paintball guns, staple guns, or conduit guns.

1.5 The values stated in inch-pound units are to be regarded as the standard; the SI units in parentheses are provided for information only.

1.6 The following precautionary caveat pertains only to the test method portion, Section 9, of this specification: *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, health and*

environmental practices and determine the applicability of regulatory limitations prior to use.

1.7 This international standard was developed in accordance with internationally recognized principles on standardization established in the *Decision on Principles for the Development of International Standards, Guides and Recommendations issued by the World Trade Organization Technical Barriers to Trade (TBT) Committee*.

## 2. Referenced Documents

2.1 *ASTM Standards*:<sup>2</sup>

**F590 Consumer Safety Specification for Non-Powder Gun Projectiles and Propellants**

2.2 *ANSI Standard*:<sup>3</sup>

**ANSI Z535 Product Safety Signs and Labels**

2.3 *NIST Standard*:<sup>4</sup>

**NIST Special Publication 811 Physical Constant-Standard Acceleration of Gravity, Conversion Factors in Appendix**

## 3. Terminology

3.1 *Definitions of Terms Specific to This Standard:*

3.1.1 *Propellant System Terms:*

3.1.1.1 *CO<sub>2</sub> (carbon dioxide)*—a propulsion system in which the energy is provided by CO<sub>2</sub> (carbon dioxide) usually stored in a removable cylinder. The release of the CO<sub>2</sub> gas provides the energy to propel the projectile.

3.1.1.2 *combination system*—a propulsion system in which a combination of spring, spring-piston, pneumatic, and CO<sub>2</sub> systems can be used to provide the energy to propel the projectile.

3.1.1.3 *pneumatic*—a propulsion system in which compressed air is stored under pressure and, when released, provides the energy to propel the projectile. A pneumatic gun normally has a pump system to provide the compressed air.

3.1.1.4 *pre-charged pneumatic*—a propulsion system in which the energy is provided by compressed gas, normally compressed air, stored in a refillable cylinder charged by an external source. The release of the compressed gas provides the energy to propel the projectile.

3.1.1.5 *spring-piston (also known as a spring-air or adiabatic system)*—a propulsion system in which the projectile is propelled by air pressure that is created by a piston moved by a spring.

3.1.1.6 *spring-type*—a propulsion system in which the projectile is placed into motion by direct contact with a spring or a carrier moved directly by a spring.

3.1.2 *Non-Powder Gun Terms:*

3.1.2.1 *adult gun*—a non-powder gun that meets the design characteristics of 8.2 and is so designated by the manufacturer.

3.1.2.2 *antique air gun*—a non-powder gun that is more than 50 years of age.

3.1.2.3 *backstop*—an object intended to stop a projectile.

3.1.2.4 *barrel*—that portion of a non-powder gun through which the projectile is discharged.

3.1.2.5 *cocking mechanism*—a device that allows the user to store manual energy.

3.1.2.6 *custom gun*—a non-powder gun designed or made to the specifications of an individual consumer.

3.1.2.7 *feed mechanism*—a mechanism that stores, transports, and loads projectiles. It may be manual, repeater, or automatic in its actions.

3.1.2.8 *hammer*—a device which, when released, discharges the stored energy.

3.1.2.9 *magazine*—a device used in a gun to store projectiles.

3.1.2.10 *non-powder gun*—a device specifically designed to discharge BB's, pellets, or darts by the release of energy stored by compressed air, compressed CO<sub>2</sub>, mechanical springs, or a combination thereof.

3.1.2.11 *piercing assembly (CO<sub>2</sub> gun)*—a device that is used to release gas from the CO<sub>2</sub> cylinder after the CO<sub>2</sub> cylinder has been correctly positioned in the gun.

3.1.2.12 *pumping mechanism (pneumatic gun)*—a mechanical device used to compress air.

3.1.2.13 *match precision gun*—a non-powder gun that meets the performance characteristics in 8.1 and is so designated by the manufacturer.

3.1.2.14 *receiver*—the main body of a rifle, shoulder gun, or long gun that houses all or most of its operating mechanisms.

3.1.2.15 *replica gun*—a functional non-powder gun manufactured to duplicate an antique non-powder gun.

3.1.2.16 *ricochet*—rebound or deflection of a projectile from a surface.

3.1.2.17 *safety, automatic*—a safety mechanism that is activated when the cocking mechanism is operated in a normal manner and must be manually deactivated by an independent action of the shooter to allow the gun to be fired by the movement of the trigger.

3.1.2.18 *safety, manual*—a safety mechanism that must be activated by an independent and deliberate action of the shooter and must be similarly released to allow the gun to be fired by the movement of the trigger.

3.1.2.19 *safety mechanism*—a device which, when activated either automatically or manually, locks a part of the non-powder gun, usually the trigger, to prevent unintentional firing in normal use. The device is sometimes referred to as a safety, safety button, or safety lever.

3.1.2.20 *sear*—the catch that holds the mechanism in the ready-to-fire position until released by the user, through trigger movement.

3.1.2.21 *shot-start force*—the force that is required to insert a non-powder gun projectile into a cavity of standard size for a given caliber.

3.1.2.22 *single-shot gun*—a gun that requires individual manual loading for each shot.

3.1.2.23 *striker*—see *hammer*.

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

<sup>3</sup> Available from American National Standards Institute (ANSI), 25 W. 43rd St., 4th Floor, New York, NY 10036, <http://www.ansi.org>.

<sup>4</sup> Available from National Institute of Standards and Technology (NIST), 100 Bureau Dr., Stop 1070, Gaithersburg, MD 20899-1070, <http://www.nist.gov>.

3.1.2.24 *target*—the object at which the projectile is discharged.

3.1.2.25 *training gun*—a non-powder gun that meets the requirements in 8.3 and is so designated by the manufacturer.

3.1.2.26 *trigger*—a device operated by the user to fire a gun.

3.1.2.27 *trigger, adjustable*—a trigger mechanism in which the trigger pull is adjustable.

3.1.2.28 *trigger, double-action*—a trigger mechanism in which a single continuous action of the trigger moves the hammer to the firing position and then releases it to discharge the projectile.

3.1.2.29 *trigger guard*—a rigid component of a non-powder gun that, together with the receiver frame or stock, completely encircles the trigger.

3.1.2.30 *trigger pull*—the force required to move the trigger from its fully engaged position to a position that fires the gun.

3.1.2.31 *trigger, single-action*—a trigger mechanism in which the hammer must be manually cocked for each shot.

3.1.2.32 *trigger, two-stage*—a trigger mechanism in which the first stage movement allows the trigger to be moved with minimum force until it encounters a resistance. The second stage requires an increased force to cause disengagement and firing of gun.

3.1.2.33 *valve*—a device used to release CO<sub>2</sub> or air from a storage chamber into the barrel during a firing cycle.

## 4. Performance Requirements

4.1 *Gun Function*—The cocking or pumping mechanism of a non-powder gun shall not cause a gun to discharge unintentionally while the gun is being cocked in accordance with the manufacturer's instructions. The feed mechanism of a non-powder gun shall not cause unintentional discharge of a projectile when a gun is used in accordance with the manufacturer's instructions. Tests shall be conducted in accordance with 9.1. If the characteristics of a cocking or pumping mechanism are such that pinch points may be exposed while a gun is being cocked, instructions and warnings identifying the hazard and providing safe procedures shall be provided with each gun in accordance with 10.4.1.9.

4.2 *Barrel Performance*—Non-powder guns shall have sufficient energy to expel the projectile intended for use with a gun when used in accordance with the manufacturer's instructions. Test shall be conducted in accordance with 9.2.

### 4.3 Trigger Mechanism:

4.3.1 The weight applied to the trigger necessary to fire a non-powder gun shall be more than 3 lb (1.35 kg) and less than 16 lb (7.3 kg). Tests shall be conducted in accordance with 9.3.

4.3.2 An adjustable trigger mechanism that is adjustable to below 2 lb (0.9 kg) must have some part of its trigger pull range above 3 lb (1.35 kg) but less than 16 lb (7.3 kg) (see 5.4.2 and 10.4.6).

4.3.3 The match precision and adult guns (see 8.1 and 8.2) are exempt from the 3 lb (1.35 kg) minimum trigger pull. This exemption shall be specified on the packages containing the special-purpose non-powder guns in accordance with 10.2.9 and in the literature packed with the gun in accordance with 10.4.4.

### 4.4 Safety Mechanism:

4.4.1 Safety mechanisms shall be provided on all non-powder guns except the special-purpose guns (Section 8) which may or may not be provided with safety mechanisms. All safety mechanisms shall be clearly marked to indicate the safe and fire positions in accordance with 10.3.4. All safety mechanisms shall be capable of preventing the guns from being fired when a weight of 30 lb (13.6 kg) is applied to the trigger. Tests shall be conducted in accordance with 9.4.

4.4.2 Special-purpose non-powder guns (Section 8), are exempt from this requirement. This exemption shall be clearly specified on the packaging in accordance with 10.2.9 and in the literature packed with the gun in accordance with 10.4.4.

### 4.5 Drop Test:

4.5.1 Non-powder guns shall be capable of withstanding a 36-in. (914-mm) drop without firing. Tests shall be conducted in accordance with 9.5.

4.5.2 The match precision and adult guns (see 8.1 and 8.2) are exempt from this requirement. This exemption shall be clearly specified on the packaging in accordance with 10.2.9 and in the literature packed with the gun in accordance with 10.4.4.

4.6 *Structural Integrity Requirement for CO<sub>2</sub> Guns*—CO<sub>2</sub> guns shall be constructed to prevent the full or partially filled CO<sub>2</sub> cylinder from being propelled from the gun while the cylinder is being emptied, installed, or removed.

4.7 *Temperature Test for CO<sub>2</sub> Guns*—CO<sub>2</sub> guns shall be capable of retaining the CO<sub>2</sub> cylinder in a pierced state when both are heated to a temperature of 160°F (71°C) and maintained for ½ h without structural failure of the gun. Tests shall be conducted in accordance with 9.6. Seal failure between the gun and cylinder is acceptable.

## 5. General Requirements

5.1 *Literature*—Literature shall be provided with each non-powder gun and shall include, as applicable, the instructions and cautionary statements specified in Section 10.

5.1.1 *Muzzle Velocity*—The muzzle velocity of the projectile of the non-powder gun shall be included in the muzzle velocity statement (see 10.4.1.4) and shall be determined in accordance with 9.7.

5.1.2 *Maximum Distance*—The maximum distance shall be included in the distance statement (see 10.4.1.4) and shall be determined in accordance with 9.8.

5.2 *Packaging*—Packaging shall be labeled in a prominent and conspicuous manner in accordance with the provisions of Section 10.

5.3 *Finish*—The exposed metal and plastic edges of all non-powder guns shall be smooth and free of sharp edges and burrs. The exposed surface of all wood parts shall be smooth and free of splinters.

### 5.4 Shipping:

5.4.1 Each non-powder gun shall be shipped in an unloaded, unchanged, and uncocked condition.

5.4.2 All non-powder guns with adjustable triggers shall have their triggers adjusted to fire at more than 2 lb (0.9 kg) and less than 16 lb (7.3 kg) at the time of shipment by the manufacturer.

5.5 All non-powder guns with an exposed, mechanical trigger shall have a trigger guard equal to or greater in width than the trigger.

**6. Significance and Use**

6.1 This consumer safety specification establishes performance requirements and test methods intended to provide a reasonable degree of safety in the normal use of non-powder guns and projectiles.

6.2 This consumer safety specification attempts to address the misuse of non-powder guns and specifies the minimum warnings and instructions that are to be provided in literature and on labels and packages.

**7. Conformance**

7.1 Non-powder guns shall not, either by label or other means, indicate conformance with this consumer safety specification unless they conform with the applicable requirements contained herein.

7.2 Any statement or symbol on the gun, package, or literature that is used to indicate that a special-purpose non-powder gun conforms with this consumer safety specification shall, where applicable, also specify the exemptions that are specifically provided for herein.

**8. Classification of Special-Purpose Non-Powder Guns (See Table 1)**

**8.1 Match Precision Guns:**

8.1.1 *Rifle*—To be classified as a match precision rifle, a non-powder gun shall be capable of firing a five-shot group such that the centers of all five shots fall within a 0.30-in. (7.6-mm) circle. The target shall be fired at a distance of 32.8 ft (10 m). These results can be obtained by shooting offhand or by using a bench rest or mechanical rest and may be evidenced by serial-numbered factory test target, fired in accordance with this specification.

8.1.2 *Hand Gun*—To be classified as a match precision hand gun, a non-powder gun shall be capable of firing a five-shot group such that the centers of all five shots fall within a 0.40-in. (10.2-mm) circle. The target shall be fired at a distance of 32.8 ft (10 m). These results can be obtained by shooting offhand or by using a bench rest or mechanical rest and may be

evidenced by serial-numbered test targets, fired in accordance with this specification.

**8.2 Adult Guns:**

8.2.1 *Rifle*—To be classified as an adult rifle, a non-powder gun shall meet the following criteria:

- 8.2.1.1 Is a single-shot per trigger pull gun,
- 8.2.1.2 Is capable of attaining a muzzle velocity of 500 ft/s (152.4 m/s) or a muzzle energy of 5.7 J or 4.2 ft-lb, or both,
- 8.2.1.3 Has a rifled barrel,
- 8.2.1.4 Is designed to fire from shoulder level,
- 8.2.1.5 Has one of the following provisions for sights on the rifle. A rear sight adjustable for windage and elevation as well as a matching front sight element or has a receiver and barrel designed to mount an adjustable rear sight as well as a matching front sight element or has provisions to mount at least one telescopic sight,
- 8.2.1.6 Has an adjustable or two-stage trigger, and
- 8.2.1.7 Has been designated as an adult air gun by the manufacturer.

8.2.2 *Hand Gun*—To be classified as an adult hand gun, a non-powder gun shall meet the following criteria:

- 8.2.2.1 Is capable of attaining a muzzle velocity of 320 ft/s (97.6 m/s) when firing projectiles 0.177 cal (4.5 mm) or smaller or 280 ft/s (85.3 m/s) when firing a projectile larger than 0.177 cal,
- 8.2.2.2 Is a single-shot per trigger pull gun,
- 8.2.2.3 Has a rifled barrel,
- 8.2.2.4 Has one of the following provisions for sights on the pistol. A rear sight adjustable for windage and elevation as well as a matching front sight element or has a receiver and barrel designed to mount an adjustable rear sight as well as a matching front sight element or has provisions to mount at least one telescopic sight,
- 8.2.2.5 Has an adjustable or two-stage trigger, and
- 8.2.2.6 Has been designated as an adult air gun by the manufacturer.

8.3 *Training Guns*—Training guns are special-purpose guns intended for use in organized educational shooting programs. Training guns are distributed through restricted programs under which they are made available only to clubs and organizations for use in their non-powder gun training programs.

**9. Test Methods**

NOTE 1—No precision statement on any of the following test methods is available at this time.

**9.1 Gun Function Test:**

9.1.1 *Significance*—This method is performed to ensure that the gun, when operated in accordance with the manufacturer’s operating instructions, will feed properly and will not discharge accidentally during the cocking or pumping and feeding cycle of the gun.

**9.1.2 Apparatus:**

- 9.1.2.1 Manufacturer’s operating instructions for the non-powder gun,
- 9.1.2.2 Projectiles and propellants conforming to Specification F590, and
- 9.1.2.3 Appropriate back stop.

**TABLE 1 Classification of Special-Purpose Non-Powder Guns<sup>A</sup>**

Classification	Exemption		
	Trigger Mechanism (4.3)	Safety Mechanism (4.4)	Drop Test (4.5)
Match-precision gun (8.1)	yes	yes	yes
Adult gun (8.2)	yes	yes	yes
Training gun (8.3)	no	yes	no

<sup>A</sup> All special-purpose non-powder guns must comply with the special marking requirements specified in Section 10 to the extent that any of the exemptions are used.

9.1.3 *Test Specimen*—The test specimen shall consist of a new non-powder gun, selected in accordance with the manufacturer’s usual quality assurance practices.

9.1.4 *Procedure:*

9.1.4.1 Conduct the test at room temperature (60 °F to 80 °F (16 °C to 27 °C)).

9.1.4.2 Insert the CO<sub>2</sub> cylinder (if required) and load the projectile magazine or chamber of a non-powder gun to capacity. For a gun of variable power, such as the CO<sub>2</sub> or pneumatic gun, cock or set the gun for the lowest power recommended by the manufacturer to fire the gun.

9.1.4.3 Operate the gun in accordance with the manufacturer’s instructions. Test fire the gun until all the projectiles have been discharged. Reload the gun, if required, and continue to fire until a minimum of 100 projectiles have been discharged.

9.1.4.4 Repeat the test at the highest power settings for guns capable of variable power.

9.1.4.5 The gun passes the test if no accidental discharge of a projectile occurred and a projectile is discharged each time the gun is fired during the test.

9.2 *Barrel Performance:*

9.2.1 *Significance*—This method is intended to determine if the barrel of a gun is of sufficient size to allow a projectile to pass freely and completely through the barrel when the gun is operated in accordance with the manufacturer’s instructions.

9.2.2 *Apparatus:*

9.2.2.1 Manufacturer’s operating instructions for the gun,

9.2.2.2 Projectiles for the gun which have shot-start forces at the high limit for the projectiles in accordance with Specification F590,

9.2.2.3 CO<sub>2</sub> cylinders, if required,

9.2.2.4 Barrel performance test gauge as shown in Fig. 1 with dimensions as described in Table 2, and

9.2.2.5 Appropriate back stop.

9.2.3 *Test Specimen*—The test specimen shall consist of a new non-powder gun, selected in accordance with the manufacturer’s usual quality assurance practices.

9.2.4 *Procedure:*

9.2.4.1 Conduct the test at room temperature (60 °F to 80 °F (16 °C to 27 °C)).

9.2.4.2 Pass the barrel bore test gage through the muzzle and the full length of the bore of the gun. The test gauge should pass freely through the bore. Remove the gauge from the muzzle end.

TABLE 2 Non-Powder Gun Bore Dimensions

Projectile	Caliber	Minimum Bore Diameter, in. (mm)
Air gun shot, steel	BB (4.5 mm)	0.1755 (4.458)
Air gun shot, lead	0.177 (4.5 mm)	0.1755 (4.458)
Air gun shot, steel	0.22 (5.5 mm)	0.2203 (5.596)
Air-gun dart	0.177 (4.5 mm)	0.1755 (4.458)
Air-gun dart	0.22 (5.5 mm)	0.2203 (5.596)

NOTE 2—Guns designed to discharge lead projectiles only are exempt from the bore gauge requirement and may be tested in accordance with 9.2.4.3.

9.2.4.3 Load the gun with projectiles (and CO<sub>2</sub> cylinder if required). Operate the gun and discharge projectiles in accordance with the manufacturer’s operating instructions for the gun. Discharge a minimum of five projectiles which have the maximum shot-start force. If the gun is capable of variable power (such as a pneumatic or CO<sub>2</sub> gun), the minimum power setting recommended by the manufacturer shall be used for this test.

9.2.4.4 The gun passes if the barrel bore test gauge passed freely through the bore and all projectiles were discharged from the barrel when fired in the intended manner. Guns intended to shoot only lead projectiles (see Note 2) pass the test if all projectiles were discharged from the barrel when fired in the intended manner.

9.3 *Trigger Pull Test:*

9.3.1 *Significance*—This method determines if the force required to pull the trigger to fire a non-powder gun is within the 3-lbf to 16-lbf (8.9-N to 71.2-N) range.

9.3.2 *Apparatus:*

9.3.2.1 A trigger weight system having a 3-lb ± 0.05-lb (1.35-kg ± 0.23 kg) weight and a 16-lb ± 0.20-lb (7.3-kg ± 0.09 kg) weight. The weight system shall be arranged so that the weights can be picked up by the trigger of the gun with the gun in a vertical position, muzzle up. (A spring gauge, capable of measuring the trigger force, can be used instead of the weight system.)

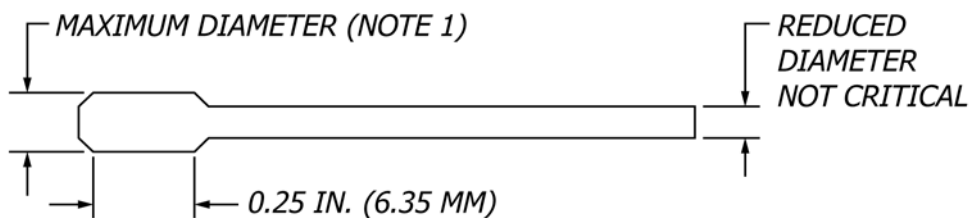
9.3.2.2 Manufacturer’s operating instructions for the non-powder gun.

9.3.3 *Test Specimen*—The test specimen shall consist of a new non-powder gun, selected in accordance with the manufacturer’s usual quality assurance practices.

9.3.4 *Procedure:*

9.3.4.1 Conduct the test at room temperature (60 °F to 80 °F (16 °C to 27 °C)).

9.3.4.2 Conduct all tests without projectiles in the gun.



NOTE 1—See Table 2 for value of minimum bore diameter and select diameter of projectile to be used.

NOTE 2—Overall length sufficient to allow the measurement of the full bore length being gaged.

FIG. 1 Barrel Performance Test Gauge

9.3.4.3 Cock or pump the gun.

9.3.4.4 Position the gun so that it can vertically lift the weight system with the weight suspended from the center of the face of the trigger.

9.3.4.5 Lift the gun slowly to lift the weight system by the trigger of the gun with the 3-lb (1.35 kg) weight in place. The gun should not fire.

9.3.4.6 Lift the gun slowly to lift the weight system by the trigger of the gun with the 16-lb (7.3 kg) weight in place. The gun should fire.

9.3.4.7 Recock the gun and repeat 9.3.4.5 and 9.3.4.6 five times.

9.3.4.8 If the gun is capable of variable power (CO<sub>2</sub> and pneumatic systems), conduct the test at both the minimum and maximum powers recommended for use by the manufacturer. Test guns having single and double-action triggers in both modes.

9.3.4.9 The gun passes if it lifts a 3-lb (1.35 kg) weight without firing and fires during the application of the 16-lb (7.3 kg) weight.

#### 9.4 Safety Mechanism Test:

9.4.1 *Significance*—This method determines if the trigger safety device will withstand a 30-lb (13.6 kg) applied weight without failure, causing the gun to fire.

9.4.2 *Apparatus*—A trigger weight system having a 30-lb ± 0.05-lb (13.6-kg ± 0.02 kg) weight. Arrange the weight system so that the weights can be picked up by the trigger of the gun with the gun in a vertical position, muzzle up. (A spring gauge, capable of measuring the trigger force, can be used instead of the weight system.)

9.4.3 *Test Specimen*—The test specimen shall consist of a new non-powder gun, selected in accordance with the manufacturer's usual quality assurance practices.

#### 9.4.4 Procedure:

9.4.4.1 Conduct the test at room temperature (60 °F to 80 °F (16 °C to 27 °C)).

9.4.4.2 Conduct all tests without projectiles in the gun.

9.4.4.3 Position the gun so that it can vertically lift the weight system with the weight suspended from the center of the face of the trigger. Cock the gun and place the safety in the "safe" or "on" position.

9.4.4.4 Slowly lift the gun to lift the weight system by the trigger of the gun and, with the 30-lb (13.6 kg) weight in place, hold for a minimum of 30 s. Remove the weight.

9.4.4.5 Put safety in "off" or "fire" position. The gun must not fire as the safety is disengaged.

9.4.4.6 Test the gun for proper trigger and safety-device action.

9.4.4.7 The gun passes the test if it withstands the weight applied without causing the gun to fire during the application of the load and does not fire upon the disengagement of the safety, and the safety and trigger function properly after testing.

#### 9.5 Drop Test:

9.5.1 *Significance*—This method determines if the non-powder gun will withstand a drop of 36 in. (914 mm) without firing and without allowing the CO<sub>2</sub> cylinder to escape (if one is used.)

#### 9.5.2 Apparatus:

9.5.2.1 *Rubber Mat*, a minimum of 50 durometer Type A, 1 in. (25 mm) thick and large enough so that when the gun is dropped it will land entirely within the perimeter of the mat,

9.5.2.2 *Concrete Floor*, on which to place the mat,

9.5.2.3 *Measure*, 36-in. (914-mm), to establish the height of the drop,

9.5.2.4 *Weight*, equal to the weight of the test specimen and having a base of no more than 4 in. (102 mm) on any one side,

9.5.2.5 *CO<sub>2</sub> Cylinders*, if required for gun operation,

9.5.2.6 *Projectiles*, to fill the magazine or an equivalent weight.

9.5.3 *Test Specimen*—The test specimen shall consist of new non-powder guns, selected in accordance with the manufacturer's usual quality assurance practices.

#### 9.5.4 Procedure:

9.5.4.1 Conduct the test at room temperature (60 °F to 80 °F (16 °C to 27 °C)).

9.5.4.2 Without any projectile in the ready-to-fire position, prepare the gun for firing by energizing and cocking it. If the gun has a safety mechanism, place the safety mechanism in the "fire" or "off" position. If the gun has an automatic safety which requires that the safety be held in the "fire" or "off" position to fire, test the gun with the safety in the "safe" or "on" position. If the gun has an adjustable trigger, adjust the trigger to its lowest setting, but in no case less than 2 lb (0.9 kg). If the gun is equipped with a magazine device, the magazine should be in place and loaded or an additional weight equal to the weight of a fully loaded magazine can be attached to the gun. Prior to dropping, be certain there is no projectile in the ready-to-fire position.

9.5.4.3 Hold the gun 36 in. (914 mm) above the mat, measured from the point on the gun that is nearest the mat. Drop the gun in the following six orientations:

(1) With barrel vertical so that the butt of the gun hits the mat.

(2) With barrel vertical so that the muzzle of the gun hits the mat.

(3) With barrel horizontal so that the bottom of the gun hits the mat.

(4) With barrel horizontal so that the top of the gun hits the mat.

(5) With barrel horizontal so that the right side of the gun hits the mat.

(6) With barrel horizontal so that the left side of the gun hits the mat.

NOTE 3—A separate gun may be used for each drop.

9.5.4.4 Test the gun after each drop to determine if the gun fired when dropped.

9.5.4.5 If the gun has an exposed hammer, conduct one additional test as follows: Disengage the safety, if the gun has a safety mechanism. Lay the gun on the mat, supporting it if necessary, such that the hammer is exposed on top or at the uppermost part of the gun. Drop the weight (9.5.2.4) from a height of 36 in. (914 mm), base first on the hammer, to determine whether this force when applied to the hammer will fire the gun.

9.5.4.6 Examine the gun to determine that the gun did not fire when dropped and inspect the gun to determine if the CO<sub>2</sub> cylinder is in place (if one is used).

9.5.4.7 Repeat all tests in 9.5.4.2, 9.5.4.3, and 9.5.4.4 with the safety in the “safe” or “on” position.

9.5.4.8 After each drop with the safety “on,” disengage the safety and determine if the gun fires while the safety is being disengaged.

9.5.4.9 If the gun has an exposed hammer, repeat 9.5.4.5 with the safety “on.” After testing, disengage the safety and determine if the gun fires while the safety is being disengaged.

9.5.4.10 The gun passes the test if it did not fire when dropped with either the safety “on” or “off,” did not fire when the safety was moved from the “on” to “off” position after being dropped, did not fire during the exposed hammer test and the CO<sub>2</sub> cylinder remained in place (if one is used), and the safety remained “on” after being dropped with the safety “on.”

#### 9.6 CO<sub>2</sub> Gun High-Temperature Test:

9.6.1 *Significance*—This method determines whether the structure of the CO<sub>2</sub> gun will withstand 160°F (71°C) for ½ h without structural failure to the gun other than the seals.

##### 9.6.2 Apparatus:

9.6.2.1 *Heating Device*, capable of being adjusted to a temperature of 160 °F ± 5 °F (71 °C ± 2.7 °C) and maintaining that temperature within ±10 °F (±5.4 °C) for ½ h, and capable of safely withstanding the rupture of the cylinder or gun that may occur during the test, and

9.6.2.2 *Scale*, capable of weighing full and empty cylinders having an accuracy of ±0.2 g.

9.6.3 *Test Specimens*—Test specimens shall consist of a new CO<sub>2</sub> gun and new CO<sub>2</sub> cylinders, selected in accordance with the manufacturer’s usual quality assurance practices.

9.6.4 *Procedure* (**Warning**—CO<sub>2</sub> cylinders may explode during the test procedure and caution should be taken by those conducting the test.):

9.6.4.1 Install the CO<sub>2</sub> cylinder in the gun and fire five shots through the gun to ensure the gun is functioning properly. Remove the cylinder.

9.6.4.2 Weigh and record the weight of a new CO<sub>2</sub> cylinder. Install and pierce the cylinder in accordance with the manufacturer’s operating instructions.

9.6.4.3 Place the gun with the installed and pierced CO<sub>2</sub> cylinder in the heating device and adjust the temperature to 160 °F (71 °C) and hold for ½ h.

9.6.4.4 Allow the gun and heating device to cool to a temperature that is safe to handle.

9.6.4.5 Remove the gun and cylinder from the heating device. Fire the gun until the CO<sub>2</sub> cylinder is empty.

9.6.4.6 Remove the cylinder from the gun. Weigh the CO<sub>2</sub> cylinder and calculate the weight of the CO<sub>2</sub> content in the original cylinder. Visually inspect the gun and cylinder for any damage.

9.6.4.7 Reload the gun with a new CO<sub>2</sub> cylinder and determine if the gun either fires properly or fails to fire.

9.6.4.8 The gun passes the test if it operated properly after the test or failed to fire altogether and no part separated from the gun (cracks are acceptable). The CO<sub>2</sub> cylinder used in the 160 °F (71°C) test originally must have held a minimum of

7.5 g of CO<sub>2</sub> for the 8-g type cylinder and 11.0 g of CO<sub>2</sub> for the 12-g type cylinder for the test to be acceptable.

#### 9.7 Velocity Test:

9.7.1 *Significance*—This method provides a procedure for determining the velocity of a projectile discharged from non-powder guns.

##### 9.7.2 Apparatus:

9.7.2.1 *Manufacturer’s Operating Instructions*, for the non-powder gun,

9.7.2.2 *Suitable Linear Measure*, for 5 ft (1.5 m) and 3 ft (0.9 m),

9.7.2.3 *Sensing Devices* (two), and a counter with a range of 0.025 s to 0.005 s with an accuracy of ± 0.0001 s, and

9.7.2.4 *Suitable Firing Range*, with backstop.

9.7.3 *Test Specimen*—The test specimen shall consist of a new non-powder gun and projectiles and propellants conforming to Specification F590 which are recommended by the manufacturer for use in the gun. The guns, projectiles, and propellants are to be selected in accordance with the manufacturer’s usual quality assurance practices.

##### 9.7.4 Procedure:

9.7.4.1 Conduct the test at room temperature (60 °F to 80 °F (16 °C to 27 °C)).

9.7.4.2 Conduct the test with each type of projectile the gun is designed to use. Weigh the projectiles and record the average weight. Set the gun at its maximum recommended adjustable power setting. For spring-piston guns, a new gun shall be fired 100 times before measuring velocity.

9.7.4.3 Position the two sensing devices at the center-to-center distance of 5 ft ± 0.05 ft (1.52 m ± 0.02 m). Place a suitable backstop in line with and to the rear of the second sensing device. Connect the sensory devices to trigger the counter “on” when the projectile passes the first sensor and “off” when the projectile passes the second sensor.

9.7.4.4 With the distance of the muzzle of the gun to the first screen at 3 ft (0.9 m), discharge a projectile through both screens at the backstop. Fire ten shots with each gun. Record the time measurements for each shot.

9.7.4.5 Using the smallest observed time, compute the maximum velocity,  $V$ , as follows:

$$V = \frac{d}{t} \quad (1)$$

where:

$V$  = velocity, ft/s (or m/s),

$d$  = distance, 5 ft (or 1.52 m), and

$t$  = time, s.

9.7.4.6 In the alternative, velocity can be determined following manufacturer’s instructions for a properly calibrated chronograph, with sensing devices set 3 ft from the muzzle and otherwise in accordance with 9.7.4.

#### 9.8 Distance Test:

9.8.1 *Significance*—This method provides a procedure for determining the distance that projectiles will travel when discharged from non-powder guns.

##### 9.8.2 Apparatus: