



Designation: F590 – 22

Standard Consumer Safety Specification for Non-Powder Gun Projectiles and Propellants¹

This standard is issued under the fixed designation F590; 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.

1. Scope

1.1 This consumer safety specification covers projectiles and propellants manufactured for use with non-powder guns intended for target shooting, educational, and recreational purposes and is to be used in conjunction with Consumer Safety Specification F589. Non-powder guns are commonly identified as BB guns, air guns, or pellet guns.

1.2 The projectiles and propellants covered by this consumer safety specification are BB cal, .177 cal (4.5 mm), .22 cal (5.5 mm), and .25 cal (6.4 mm) air gun shot of various materials; .177 cal (4.5 mm), 5 mm, .22 cal (5.5 mm), .25 cal (6.4 mm) pellets and .177 cal (4.5 mm), 5 mm, .22 cal (5.5 mm), and .25 cal (6.4 mm) darts and propellants identified as 8 and 12-g type CO₂ cylinders with both small and standard-sized necks as well as refillable CO₂ or compressed air cylinders and reservoirs.

1.3 This consumer safety specification does not cover propellants such as dichlorodifluoromethane or projectiles that are propelled by a combustible release of energy; non-powder gun projectiles used with products identified as blow guns, sling shots, cork guns, toy guns, or archery cross bows and other such devices; projectiles designed for adult use in obsolete non-powder guns, custom-made non-powder guns, and non-powder guns designed for and used by law enforcement, scientific, veterinary or military use; paint ball markers, ammunition for airsoft/softair guns and shot used with shotguns in the firearm classification. Test methods for refilling cylinders do not purport to address all of the safety issues, if any, associated with the safe handling and transfilling of small cylinders. It is the responsibility of the user of this standard to establish appropriate safety practices and determine the applicability of regulatory limitations, such as but not limited to DOT, CGA and OSHA, prior to use.

1.4 The following precautionary caveat pertains only to the test method portion, Section 7, 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.

1.5 *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:*²

F589 Consumer Safety Specification for Non-Powder Guns
F2030 Specification for Paintball Cylinder Burst Disk Assemblies

3. Terminology

3.1 *Definitions of Terms Specific to This Standard:*

Projectiles

3.1.1 *air-gun dart*—a .177 cal, 5 mm, .22 cal, or .25 cal non-powder gun projectile having a pointed configuration on one end and tufts on the other (see Fig. 1).

3.1.1.1 *tuft*—the material that is added to the body of a dart.

3.1.2 *air-gun shot*—a BB, .177, .22 cal, or .25 cal ball-shaped, non-powder gun projectile made primarily of lead, lead alloy, or steel (see Fig. 2).

3.1.2.1 *air-gun shot, lead*—a shot made of lead or lead alloy which may or may not have a protective finish.

3.1.2.2 *air-gun shot, lead-coated*—a shot made of steel that has a thin, uniform coating of lead or lead alloy. It may or may not have a protective finish.

3.1.2.3 *air-gun shot, steel*—a shot made of steel that is coated with a protective finish.

3.1.2.4 *dimension across flats*—the diameter of an air-gun shot, as measured across the flats.

3.1.2.5 *maximum spherical diameter*—the largest diameter of an air-gun shot, as measured with a ring gauge.

¹ 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.

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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.

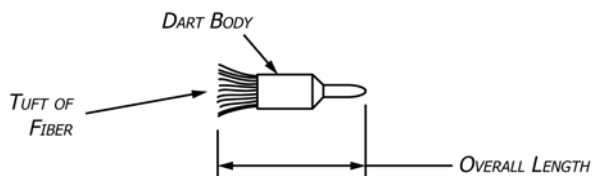


FIG. 1 Air-Gun Dart

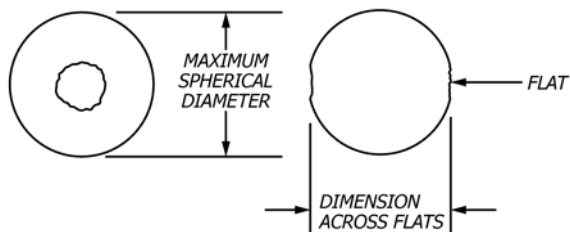


FIG. 2 Air-Gun Shot

3.1.3 *caliber*—the nomenclature used to indicate the bore size of a non-powder gun and the compatible projectile intended for use with that bore size.

3.1.4 *non-powder gun projectile*—a projectile that is designed for and intended to be discharged from a non-powder gun.

3.1.5 *pellet*—a .177 cal, 5 mm, .22 cal, or .25 cal nonspherical, semihollow non-powder gun projectile made of lead, lead alloy, or other material, or a combination thereof. Typical examples are shown in Fig. 3.

3.1.5.1 *nose of pellet*—the forwardmost portion of a pellet.

3.1.5.2 *overall length of pellet*—the maximum dimension of a pellet as measured parallel to the axis.

3.1.6 *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. *Propellants*

3.1.7 *CO₂ (carbon dioxide) cylinder non-refillable*—a cylinder that holds carbon dioxide in a liquid-gas combination and consists of a main body or container and a neck containing the cap and seal (see Fig. 4) for use in non-powder guns.

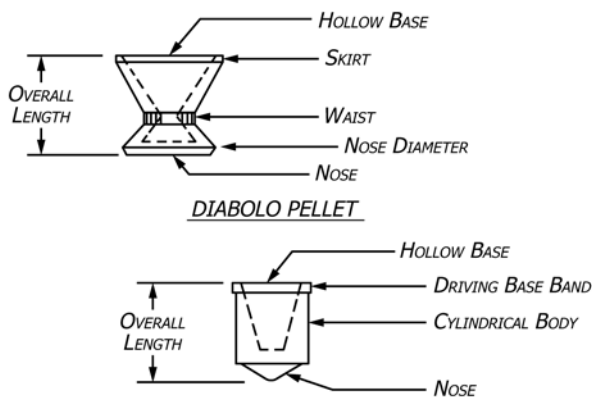


FIG. 3 Air-Gun Pellets

3.1.7.1 *cap, CO₂ cylinder*—the section of the cylinder neck containing the seal that is punctured to release CO₂ for use in the non-powder gun.

3.1.7.2 *neck diameter, CO₂ cylinder*—the outside diameter of the neck of a CO₂ cylinder.

3.1.7.3 *neck length, CO₂ cylinder*—the distance the neck of a cylinder enters into a hole equal to the maximum allowable neck diameter (see Fig. 5).

3.1.7.4 *overall length, CO₂ cylinder*—the length measured parallel to the longitudinal axis of the cylinder.

3.1.7.5 *outside diameter, CO₂ cylinder*—the diameter of the main body of the CO₂ cylinder.

3.1.8 *CO₂ (carbon dioxide) cylinder refillable*—a cylinder that holds carbon dioxide in a liquid-gas combination consisting of a cylinder and a self-activating on/off valve assembly for use on non-powder guns.

3.1.9 *propellant, CO₂ (carbon dioxide)*—a propellant in which the energy source is obtained from compressed carbon dioxide gas.

3.1.10 *propellant, compressed*—a propellant in which the energy source is obtained from compressed air or other nonflammable gas.

3.1.11 *propellant, refillable removable*—also known as *removable CO₂ cylinders refillable*, a cylinder and valve assembly which is removed from the non-powder guns to be refilled.

3.1.12 *propellant, refillable non-removable*—a reservoir contained within the non-powder guns which by its design is not easily removable however is refillable with a non-flammable gas.

3.1.13 *propellant, non-refillable*—also known as *CO₂ cylinders, non-refillable*, generally referred to as disposable cartridges which are discarded after use and are not refillable for use in non-powder guns.

Fill Stations

3.1.14 *fill station*—a device designed to attach to a CO₂ or compressed air cylinder and to a refillable non-powder guns cylinder to facilitate transfilling of the non-powder gun's cylinder or a device designed to attach a CO₂ or compressed air cylinder to a non-powder gun to facilitate the transfilling a non-removable reservoir contained within the non-powder guns.

3.1.15 *authorized retester*—a facility registered with and approved by DOT for the re-qualification of refillable CO₂ cylinders.

3.1.16 *blow-down valve*—a valve which is part of a fill station assembly for refilling CO₂, which is intended to vent gas from the cylinder and fill station.

3.1.17 *DOT*—Department of Transportation.

3.1.18 *TC*—Transport Canada.

3.1.19 *valve twist test*—a test done by hand whereas the user grasps the valve with one hand and the bottle with the other and attempts to turn the valve by hand in a counter-clockwise direction (left).

3.1.19.1 *Discussion*—If the valve does move, the valve and bottle should not be filled and should be repaired or serviced,

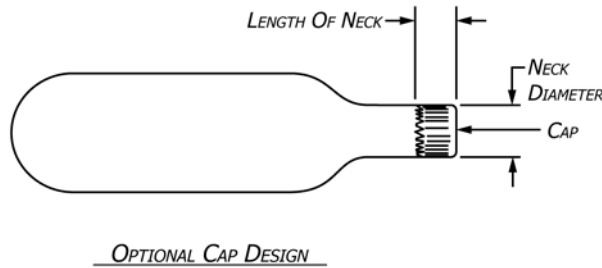
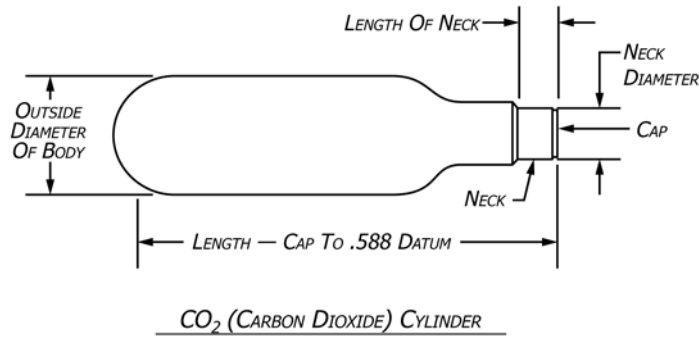


FIG. 4 CO₂ (Carbon Dioxide) Cylinder Non-Refillable

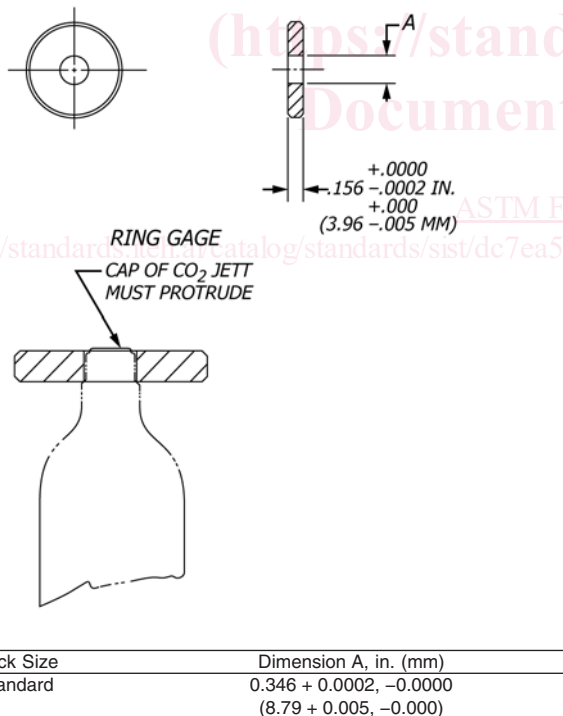


FIG. 5 CO₂ Cylinder Non-Refillable Combination Gauge (C.R.S.) Maximum Neck Diameter and Minimum Neck Length (Standard Neck Cylinder)

be filled provided it passes all other requirements. The test should only be done when the cylinder is empty and without any tools.

4. Requirements

4.1 Projectiles:

4.1.1 *Air-Gun Shot, Steel*—Air-gun shot, steel, shall conform to the minimum and maximum diameter dimensions specified in Table 1 when measured in accordance with 7.1 and 7.2.

4.1.2 *Air-Gun Shot, Lead*—Air-gun shot, lead, shall conform to the minimum diameter dimensions specified in Table 2 when measured in accordance with 7.3 and shall conform to the maximum shot-start force as specified in Table 3 when measured in accordance with 7.4.

4.1.3 *Pellets*—Pellets shall conform to the minimum and maximum length dimensions as specified in Table 4 when measured in accordance with 7.5 and shall conform to the maximum shot-start force as specified in Table 5 when measured in accordance with 7.4.

4.1.4 *Air-Gun Darts*—Air-gun darts shall conform to the minimum and maximum length dimensions as specified in Table 6 when measured in accordance with 7.5 and shall

TABLE 1 Air-Gun Shot (Steel)—Diameters

Projectile Type	Maximum Spherical Diameter, in. (mm)	Minimum Dimension Across Flats, in. (mm)
Air-gun shot, steel, BB cal (.177 cal)	0.175 (4.44)	0.162 (4.11)
Air-gun shot, steel, .22 cal	0.2198 (5.583)	0.205 (5.21)

or both, by the manufacturer or its authorized representative. If the valve does not move then the valve passes the test and may

TABLE 2 Air-Gun Shot (Lead)—Diameters

Projectile Type	Minimum Diameter, in. (mm)
Air-gun shot, lead, .177 cal	0.162 (4.11)
Air-gun shot, lead, .22 cal	0.205 (5.21)

conform to the maximum shot-start force as specified in [Table 7](#) when measured in accordance with [7.4](#).

4.1.5 Finish and Appearance—The outermost surfaces of all projectiles that require protection against deterioration shall have a protective finish.

4.2 Propellants—Compressed air, nitrogen gas, and CO₂ gas propellant may be combined with additional ingredients for use as propellants for non-powder guns, but the propellant shall be noncombustible.

4.3 CO₂ Cylinder Non-Refillable:

4.3.1 CO₂ Cylinder Measurement Test—CO₂ cylinders shall conform with the appropriate dimensions and tolerances in [Table 8](#) and [Table 9](#) when measured in accordance with [7.6](#). For sizes of CO₂ cylinder non-refillable not listed in [Table 8](#) or [Table 9](#), this test will not be complete.

4.3.2 CO₂ Cylinder Non-Refillable Temperature Test—CO₂ cylinders shall withstand a temperature as defined in [7.6.4.1](#) without leaking or bursting when tested in accordance with [7.6](#).

4.3.3 Rupture Test—CO₂ cylinders that have been tested in accordance with [7.6](#) and [7.8](#) shall not fragment or splinter upon rupture. Failure shall not occur at the cap or neck section of the cylinder.

4.3.4 Finish and Appearance—The outermost surfaces of CO₂ cylinders that require protection against deterioration shall have a protective finish.

5. Significance and Use

5.1 This consumer safety specification establishes the dimensions and tolerances and supporting test methods for non-powder gun projectiles and propellants to ensure compatibility between the projectiles and propellants and the non-powder guns for which they are designed.

5.2 This consumer safety specification identifies non-powder gun projectiles and propellants and establishes product identification requirements. The product identification requirements are intended to guide users of non-powder guns in selecting the correct projectile or propellant for use in various guns, and attempts to prevent hazards associated with incorrect use of projectiles and propellants.

6. Conformance

6.1 Non-powder gun projectiles and propellants produced after the effective date of this consumer safety specification shall not, either by label or other means, indicate conformance with this consumer safety specification unless they conform with all the requirements contained herein.

7. Test Methods

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

7.1 Measurement of Maximum Spherical Diameter of Air-Gun Shot, Steel (see [Fig. 2](#) and [Table 1](#)):

7.1.1 Significance—The purpose of this test method is to establish the maximum diameter of air-gun shot, steel, to ensure that the projectile will be compatible with the non-powder gun for which it is intended.

7.1.2 Apparatus:

7.1.2.1 Ring Gauge, with a minimum thickness of 0.125 in. (3.18 mm) and a hole diameter with the maximum diameter in [Table 1](#) ±0.0001 in. (+0.002 mm). The ring gauge is used to determine whether the air-gun shot exceeds the appropriate maximum spherical diameter in [Table 1](#).

7.1.2.2 Screening Plate (optional), with holes 0.001 in. ± 0.0001 in. (0.025 mm ± 0.002 mm) smaller in diameter than the maximum diameter of the ring gauge specified in [7.1.2.1](#). The screening plate may be used to select or screen only the largest shot for measurement with the ring gauge.

7.1.3 Test Specimen—Test specimens shall consist of new air-gun shot, selected in accordance with the manufacturer's usual quality assurance practices.

7.1.4 Procedure:

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

7.1.4.2 A screening plate may be used to reduce the number of shot which must be passed through the ring gauge. If the screening plate in [7.1.2.2](#) is used, place the test specimen on the plate. Shake the plate so that the smaller shot pass through the screen and the larger shot remain on the screen. Collect the larger shot remaining on the screen for measurement with the ring gauge. Inspect the shot which have passed through the screening plate and sort all abnormal shot from the lot which was passed through the screen for measurement with the ring gauge.

7.1.4.3 Place each shot in the hole of the ring gauge with the maximum spherical diameter shown in [Table 1](#). Roll the shot in the ring gauge so that the diameters of the three perpendicular axes of the shot are exposed to the hole in the ring gauge. Shot that does not roll within the ring gauge is oversized and fails the test.

7.2 Measurement of Flat Dimensions of Air-Gun Shot, Steel ([Fig. 2](#)):

7.2.1 Significance—The purpose of this test method is to measure the dimensions across the flats of air-gun shot, steel, to ensure that the shot will be compatible with the gun and the feed system for which it is intended.

7.2.2 Apparatus:

7.2.2.1 Pointed Micrometer, capable of measuring with an accuracy of ±0.0001 in. (±0.002 mm).

7.2.3 Test Specimen—Test specimens shall consist of new air-gun shot, selected in accordance with the manufacturer's usual quality assurance practices.

NOTE 2—The test specimens used in [7.1](#) may be used for this test.

7.2.4 Procedure:

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

TABLE 3 Air-Gun Shot (Lead)—Shot-Start Force and Gauge Dimensions and Tolerances

Projectile Type	Maximum Shot-Start Force, lbf (N)	Gauge Dimensions and Tolerances (see Fig. 6), in. (mm)		
		Punch Diameter, ±0.001 in. (±0.025 mm)	Inside Diameter, ±0.0001 in. (±0.0025 mm)	Guide Inside Diameter, ±0.001 in. (±0.025 mm)
Air-gun shot, lead, .177 cal	22.5 (100)	0.093 (2.36)	0.175 (4.45)	0.1935 (4.915)
Air-gun shot, lead, .22 cal	20.0 (89)	0.125 (3.18)	0.216 (5.49)	0.234 (5.94)

TABLE 4 Air-Gun Pellets (Lead)—Maximum and Minimum Lengths

Projectile Type	Overall Length, in. (mm)	
	max	min
Air-gun pellet, lead, .177 cal	0.260 (6.60)	0.195 (4.96)
Air-gun pellet, lead, 5 mm	0.295 (7.49)	0.225 (5.71)
Air-gun pellet, lead, .22 cal	0.311 (7.90)	0.230 (5.84)
Air-gun pellet, lead, .25 cal	0.433 (11)	0.264 (6.7)

7.2.4.2 Measure each shot and record the micrometer reading of the shot from a flat to the opposite surface if one flat exists, or from flat to flat if two flats exist.

7.2.4.3 The shot is acceptable if the diameter measured is equal to or greater than the minimum dimension of the flats specified in Table 1.

7.3 Measurement of Minimum Diameter of Air-Gun Shot, Lead (Table 2):

7.3.1 *Significance*—The purpose of this method is to measure the minimum diameter of air-gun shot, lead, to ensure that the shot will be compatible with the gun and the feed system for which it is intended.

7.3.2 Apparatus:

7.3.2.1 *Micrometer* (0 in. to 1 in. (0 mm to 25 mm)), having an accuracy of ±0.0001 in. (±0.002 mm).

7.3.3 *Test Specimen*—Test specimens shall consist of new air-gun shot, selected in accordance with the manufacturer's usual quality assurance practices.

7.3.4 Procedure:

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

7.3.4.2 Measure the diameter at three different positions. If the shot appears to have a particular diameter or diameters that are smaller than other diameters, then choose the smaller diameters to be measured (such as diameter across one or more flats).

7.3.4.3 The shot is acceptable if all diameters measured are equal to or greater than those specified in Table 2.

7.4 Shot-Start Force Measurement of Air-Gun Shot (Lead), Pellets, and Darts (Table 3, Table 5, and Table 6):

7.4.1 *Significance*—The purpose of this test method is to measure the force required to push an air-gun shot (lead), a pellet, or a dart into a standard size hole that represents the bore of a gun. This procedure is intended to ensure compatibility between projectiles and the non-powder guns for which they are designed.

7.4.2 Apparatus:

7.4.2.1 *Special Shot-Start Force Test Fixture*, as shown in Fig. 6, having gauge and punch diameters as provided in Table 3, Table 5, or Table 6, which are appropriate for the projectiles being tested.

7.4.2.2 *Scale*, suitable spring weight having an accuracy of ±0.2 lbf (±0.89 N).

7.4.3 *Test Specimen*—Test specimens shall consist of new air-gun shot (lead), pellets, or darts, selected in accordance with the manufacturer's usual quality assurance practices.

7.4.4 Procedure:

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

7.4.4.2 Place a test specimen nose first into the guide section of the shot-start force fixture. Place the punch on the rear of the test specimen and apply force to the punch with the spring scale. Observe the force of the spring scale and record the highest force required to push the test specimen completely into the inside diameter of the gauge section of the shot-start force test fixture.

NOTE 3—If the test is conducted in a vertical position, add the weight of the punch to the load applied by the spring scale to determine the amount of applied force.

7.4.4.3 The shot is acceptable if the shot-start force measured is equal to or less than that specified in Table 3, Table 5, or Table 6.

7.5 Pellet and Air-Gun Dart Length Measurements (Table 4 and Table 7):

7.5.1 *Significance*—The purpose of this method is to measure the length of pellets and air-gun darts to ensure that the pellets and air-gun darts are compatible with the gun for which they are intended.

7.5.2 Apparatus:

7.5.2.1 *Micrometer*, having an accuracy of ±0.001 in. (±0.02 mm).

7.5.2.2 *Ruler*, with 1/64-in. (0.5-mm) graduations.

7.5.3 *Test Specimen*—Test specimens shall consist of new pellets or air-gun darts, selected in accordance with the manufacturer's usual quality assurance practices.

7.5.4 Procedures:

7.5.4.1 Conduct tests at room temperature (60 °F to 80 °F (16 °C to 27 °C)).

7.5.4.2 Measure the length of each pellet using the micrometer and the length of each dart using the ruler. Measure the length parallel to the major axis of the projectile.

7.5.4.3 The pellet or dart is acceptable if the length measured falls within the dimensions shown in Table 4 or Table 7.

7.6 CO₂ Cylinder Non-Refillable Temperature Test:

7.6.1 *Significance*—The purpose of this method is to determine whether CO₂ cylinders will withstand a temperature as defined in 7.6.4.1 without failure or leakage.

7.6.2 Apparatus:

TABLE 5 Air-Gun Pellets (Lead)—Shot-Start Force and Gauge Dimensions and Tolerances

Projectile Type	Maximum Shot-Start Force, lbf (N)	Shot-Start Gauge Dimensions, in. (mm) (see Fig. 6)		
		Punch Diameter, ±0.001 in. (±0.025 mm)	Inside Diameter, ±0.0001 in. (±0.0025 mm)	Guide Inside Diameter, ±0.001 in. (±0.025 mm)
Air-gun pellet, lead, .177 cal	24.0 (107)	0.093 (2.36)	0.175 (4.45)	0.1935 (4.915)
Air-gun pellet, lead, 5 mm	23.0 (102)	0.093 (2.36)	0.1959 (4.981)	0.205 (5.21)
Air-gun pellet, lead, .22 cal	21.5 (95.6)	0.125 (3.18)	0.216 (5.49)	0.234 (5.94)
Air-gun pellet, lead, .25 cal	19.2 (85.5)	0.15 (3.81)	0.248 (6.3)	0.2677 (6.8)

TABLE 6 Air-Gun Darts—Shot-Start Force and Gauge Dimensions and Tolerances

Projectile Type	Maximum Shot-Start Force, lbf (N)	Shot-Start Gauge Dimensions, in. (mm) (see Fig. 6)		
		Punch Diameter, ±0.001 in. (±0.025 mm)	Inside Diameter, ±0.0001 in. (±0.0025 mm)	Guide Inside Diameter, ±0.001 in. (±0.025 mm)
Air-gun dart, .177 cal	1 (4.5)	0.093 (2.36)	0.175 (4.45)	0.1935 (4.915)
Air-gun dart, 5 mm	1 (4.5)	0.093 (2.36)	0.1959 (4.981)	0.205 (5.21)
Air-gun dart, .22 cal	1 (4.5)	0.125 (3.18)	0.216 (5.49)	0.234 (5.94)

TABLE 7 Air-Gun Darts—Maximum and Minimum Lengths

Projectile Type	Overall Length, in. (mm)	
	max	min
Air-gun dart, .177 cal	1.5 (38)	none
Air-gun dart, 5 mm	1.5 (38)	none
Air-gun dart, .22 cal	1.5 (38)	none

TABLE 8 CO₂ Cylinders Non-Refillable—Diameter and Length

Nominal Cylinder Size	Maximum Outside Diameter, in. (mm)	Length, Cap to .588 Datum, in. (mm)	
		max	min
Small size (8-g type)	0.744 (18.90)	2.418 (61.42)	2.358 (59.89)
Large size (12-g type)	0.744 (18.90)	3.138 (79.71)	3.058 (77.67)

TABLE 9 CO₂ Cylinders Non-Refillable—Neck Length and Diameter

Nominal Cylinder	Small Neck, in. (mm)		Standard Neck, in. (mm)	
	Minimum Length	Maximum Diameter	Minimum Length	Maximum Diameter
Small size (8-g type)	0.157 (3.98)	0.295 (7.49)	0.157 (3.98)	0.345 (8.76)
Large size (12-g type)	0.157 (3.98)	0.295 (7.49)	0.157 (3.98)	0.345 (8.76)

7.6.2.1 *Heating Device*, capable of heating CO₂ cylinders to a temperature of 160 °F ± 10 °F (71 °C ± 5.6 °C) and capable of withstanding damage from CO₂ cylinders that may rupture during the test.

7.6.2.2 *Gram Scale*, having an accuracy of ±0.1 g to measure the weight of a CO₂ cylinder.

7.6.3 *Test Specimen*—All (100 %) CO₂ cylinders for use in non-powder guns shall be subjected to this test.

7.6.4 *Procedure*—(**Warning**—CO₂ cylinders may explode during the test procedure. Precautions should be taken for those conducting the test.)

7.6.4.1 Adjust the temperature to 160 °F ± 10 °F (71 °C ± 5.6 °C).

7.6.4.2 Weigh the individual CO₂ cylinders and remove any obviously overweight or underweight cylinders in accordance with the manufacturer's usual quality assurance practices. Place the balance of the cylinders in the heating device and permit them to reach the equilibrium temperature as defined in 7.6.4.1 for a minimum of 30 min.

7.6.4.3 Remove all ruptured CO₂ cylinders from the batch and discard.

7.6.4.4 Weigh all (100 %) CO₂ cylinders following the 100 % temperature test as defined in 7.6.4.1, to establish any weight loss below the acceptable limit. Remove any cylinders having a fill of less than 3 g.

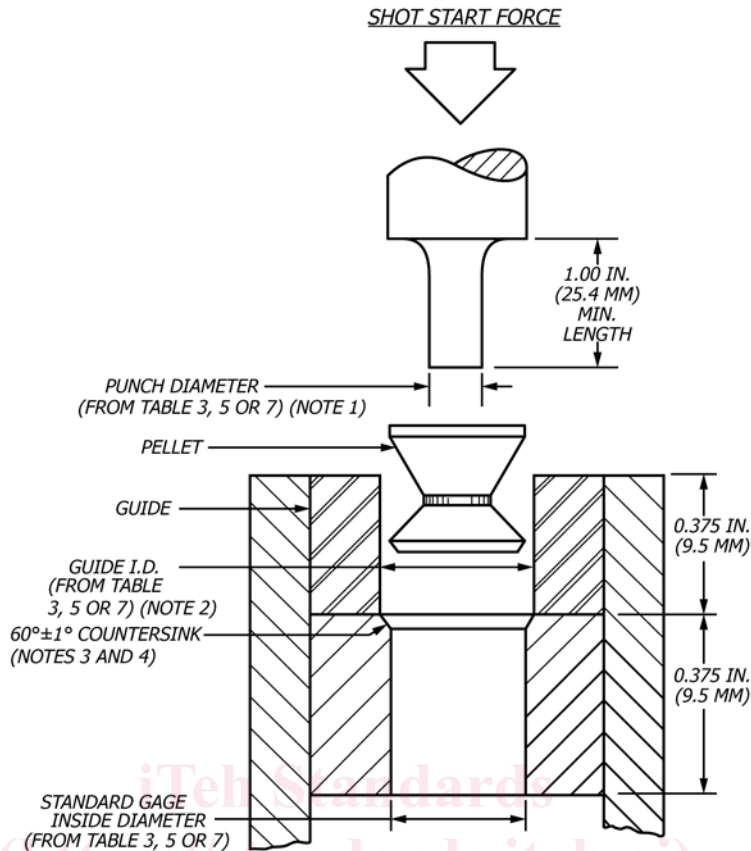
7.7 *CO₂ Cylinder Non-Refillable Measurements (Tables 8 and 9):*

7.7.1 *Significance*—The purpose of this test method is to ensure the interchangeability of CO₂ cylinders with the non-powder guns designed to accept them. For sizes of CO₂ cylinder non-refillable not listed in Table 8 or Table 9, this test will not be complete.

7.7.2 *Apparatus:*

7.7.2.1 *Ring Gauge*—as specified in Fig. 7.

7.7.2.2 *Ring Gauge*—as specified in Fig. 5 or Fig. 8.



- NOTE 1—Punch shall be directed and controlled to prevent contact with guide or inside diameter of gage.
 NOTE 2—Bore of guide to be concentric with bore of gauge within 0.003 in. (0.076 mm).
 NOTE 3—60-deg countersink and inside diameter finished to 1 μ m. (0.4/0.2 μ m).
 NOTE 4—A 0.005/0.010-in. (0.127/0.254-mm) radius is required at intersection of 60-deg countersink and inside diameter.

FIG. 6 Shot-Start Force Test Fixture

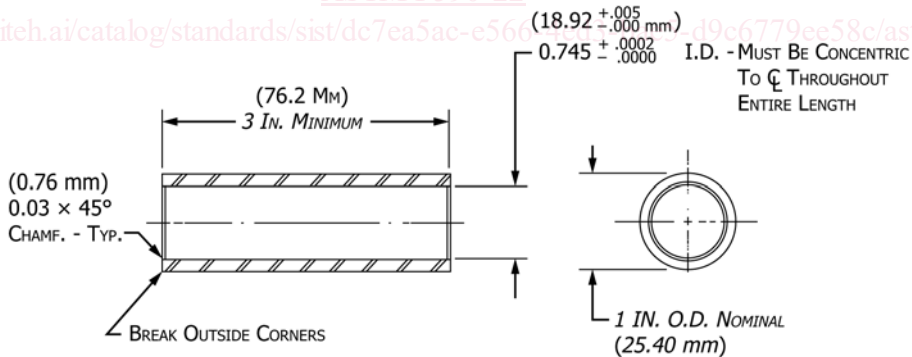


FIG. 7 Ring Gauge—CO₂ Cylinder Non-Refillable Diameter

7.7.2.3 *Dial Indicator*, with an accuracy of ± 0.001 in. (0.03 mm), and setting gauge block (see Fig. 8) to measure overall length (cap to 0.588 datum) in 7.7.5.3 (see Fig. 4).

7.7.3 *Test Specimen*—Test specimens shall consist of new CO₂ cylinders that have passed the test in 7.6 and that are selected in accordance with the manufacturer’s usual quality assurance practices.

7.7.4 *Gauge Calibration*—Set the length, cap to 0.588 datum gauge (see Fig. 8), to the mean by placing the dial

setting gauge block in the gauge and adjusting the face of the indicator such that the needle points to zero.

7.7.5 *Procedure:*

7.7.5.1 Check the diameter and concentricity to the longitudinal axis by passing the cylinder through the 3-in. (76.2-mm) long ring gauge (see Fig. 7). The cylinder must pass through the gauge freely.

7.7.5.2 Using the proper combination gauge (standard or small neck) (see Fig. 5 and Fig. 8), place the gauge as far down