Designation: F590 – 12

Standard Consumer Safety Specification for Non-Powder Gun Projectiles and Propellants[1]

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 CO_2 cylinders with both small and standard-sized necks as well as refillable CO_2 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 and health practices and determine the applicability of regulatory limitations prior to use.*

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 gage.

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.

[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.

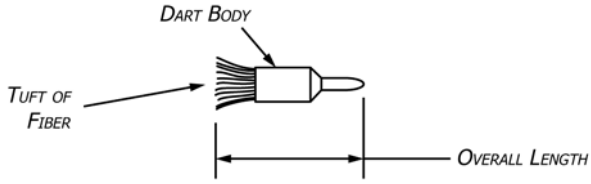


FIG. 1 Air-Gun Dart

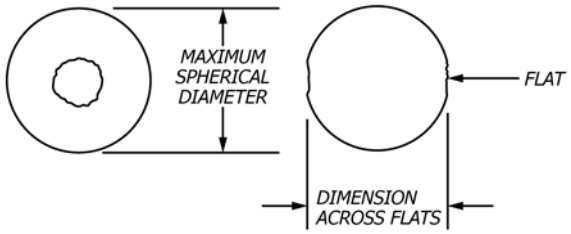


FIG. 2 Air-Gun Shot

3.1.5 *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 *CO_2 (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.

3.1.7.1 *cap, CO_2 cylinder*—the section of the cylinder neck containing the seal that is punctured to release CO_2 for use in the non-powder gun.

3.1.7.2 *neck diameter, CO_2 cylinder*—the outside diameter of the neck of a CO_2 cylinder.

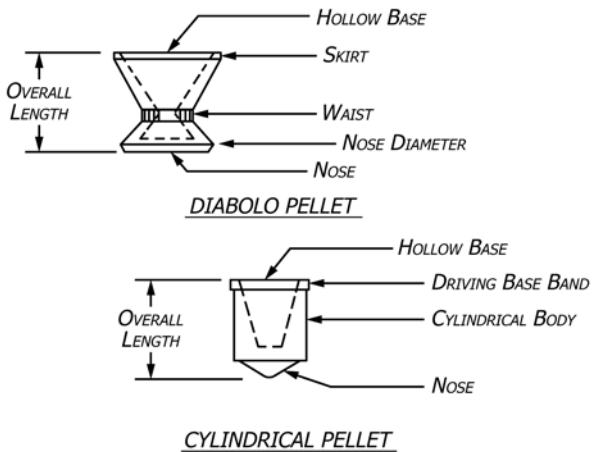


FIG. 3 Air-Gun Pellets

3.1.7.3 *neck length, CO_2 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, CO_2 cylinder*—the length measured parallel to the longitudinal axis of the cylinder.

3.1.7.5 *outside diameter, CO_2 cylinder*—the diameter of the main body of the CO_2 cylinder.

3.1.8 *CO_2 (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, CO_2 (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 CO_2 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 CO_2 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 CO_2 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 CO_2 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 CO_2 cylinders.

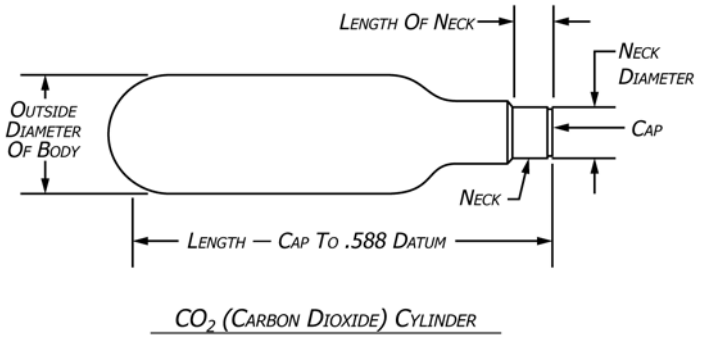
3.1.16 *blow-down valve*—a valve which is part of a fill station assembly for refilling CO_2, which is intended to vent gas from the cylinder and fill station.

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, or both, by the manufacturer or its authorized representative. If the valve does not move then the valve passes the test and may be filled provided it passes all other requirements. The test should only be done when the cylinder is empty and without any tools.



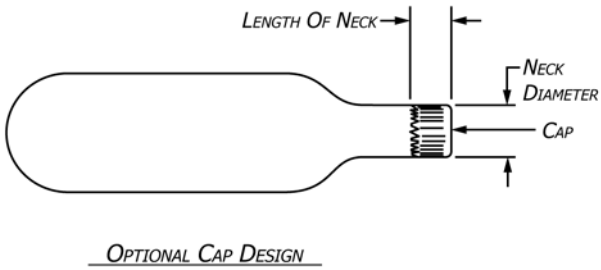
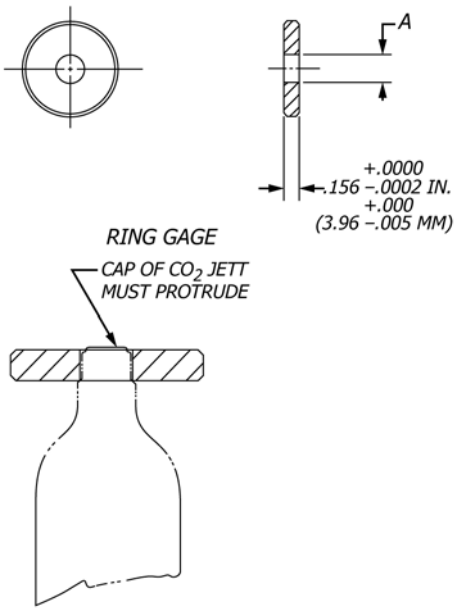


FIG. 4 CO_2 (Carbon Dioxide) Cylinder Non-Refillable



Neck Size	Dimension A, in. (mm)
Standard	0.346 + 0.0002, –0.0000 (8.79 + 0.005, –0.000)

FIG. 5 CO_2 Cylinder Non-Refillable Combination Gage (C.R.S.) Maximum Neck Diameter and Minimum Neck Length (Standard Neck Cylinder)

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 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.

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)

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)

4.2 *Propellants*—Compressed air, nitrogen gas, and CO_2 gas propellant may be combined with additional ingredients for use as propellants for non-powder guns, but the propellant shall be noncombustible.

4.3 *CO_2 Cylinder Non-Refillable:*

4.3.1 *CO_2 Cylinder Measurement Test*—CO_2 cylinders shall conform with the appropriate dimensions and tolerances in Table 8 and Table 9 when measured in accordance with 7.6.

4.3.2 *CO_2 Cylinder Non-Refillable Temperature Test*—CO_2 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*—CO_2 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 CO_2 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 Gage,* 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 gage 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 ± 0.0001-in. (0.025 ± 0.002-mm) smaller in diameter than the maximum diameter of the ring gage 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 gage.

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 to 80°F (16 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 gage. 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 gage. 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 gage.

7.1.4.3 Place each shot in the hole of the ring gage with the maximum spherical diameter shown in Table 1. Roll the shot in the ring gage so that the diameters of the three perpendicular axes of the shot are exposed to the hole in the ring gage. Shot that does not roll within the ring gage 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 to 80°F (16 to 27°C)).

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):*

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

Projectile Type	Maximum Shot-Start Force, lbf (N)	Gage 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)

7.3.1 *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 to 1 in. (0 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 to 80°F (16 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 gage 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 to 80°F (16 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 gage 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 to 80°F (16 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 *CO_2 Cylinder Non-Refillable Temperature Test:*

7.6.1 *Significance*—The purpose of this method is to determine whether CO_2 cylinders will withstand a temperature as defined in 7.6.4.1 without failure or leakage.

7.6.2 *Apparatus:*

7.6.2.1 *Heating Device,* capable of heating CO_2 cylinders to a temperature of 160 ± 10°F (71 ± 5.6°C) and capable of withstanding damage from CO_2 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 CO_2 cylinder.

7.6.3 *Test Specimen*—All (100 %) CO_2 cylinders for use in non-powder guns shall be subjected to this test.

7.6.4 *Procedure:*

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

Projectile Type	Maximum Shot-Start Force, lbf (N)	Shot-Start Gage 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 Gage Dimensions and Tolerances

Projectile Type	Maximum Shot-Start Force, lbf (N)	Shot-Start Gage 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 CO_2 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 CO_2 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)

NOTE 4—**Caution:** CO_2 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 ± 10°F (71 ± 5.6°C).

7.6.4.2 Weigh the individual CO_2 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 CO_2 cylinders from the batch and discard.

7.6.4.4 Weigh all (100 %) CO_2 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 *CO_2 Cylinder Non-Refillable Measurements* (Tables 8 and 9)*:*

7.7.1 *Significance*—The purpose of this test method is to ensure the interchangeability of CO_2 cylinders with the non-powder guns designed to accept them.

7.7.2 *Apparatus:*

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

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

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

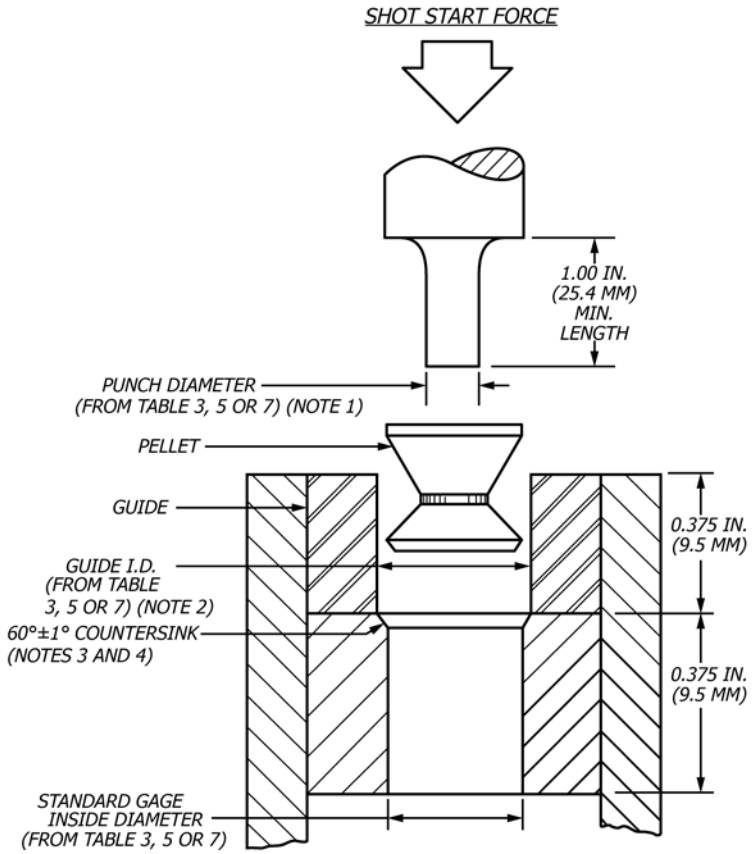
7.7.3 *Test Specimen*—Test specimens shall consist of new CO_2 cylinders that have passed the test in 7.6 and that are selected in accordance with the manufacturer's usual quality assurance practices.

7.7.4 *Gage Calibration*—Set the length, cap to 0.588 datum gage (see Fig. 8), to the mean by placing the dial-setting gage block in the gage 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 gage (see Fig. 7). The cylinder must pass through the gage freely.

7.7.5.2 Using the proper combination gage (standard or small neck) (see Fig. 5 and Fig. 8), place the gage as far down on the cylinder neck as it will go without using force. The cap



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 gage within 0.003 in. (0.076 mm).
NOTE 3—60-deg countersink and inside diameter finished to 16⁄8 µin. (0.4/0.2 µm).
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

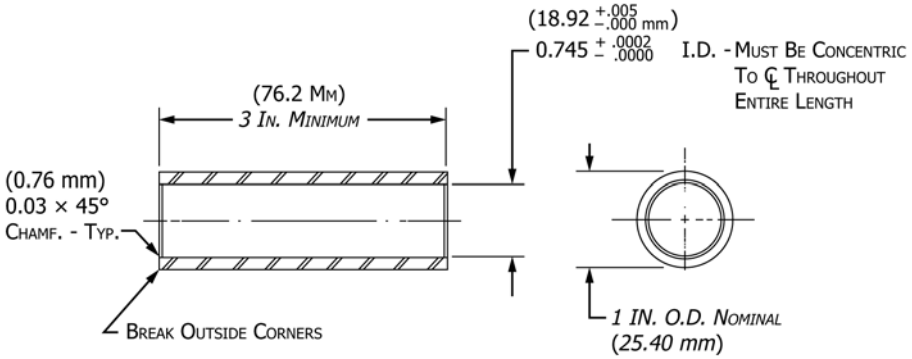


FIG. 7 Ring Gage—CO_2 Cylinder Non-Refillable Diameter

must protrude through the gage such that it may be felt by the fingernail or metal rule, when passed across the hole.

7.7.5.3 Measure the length (cap to 0.588 datum) by inserting the cylinder into the gage (Fig. 9) with the cap toward the indicator. The length to datum must fall between the tolerance limits prescribed in Table 8.

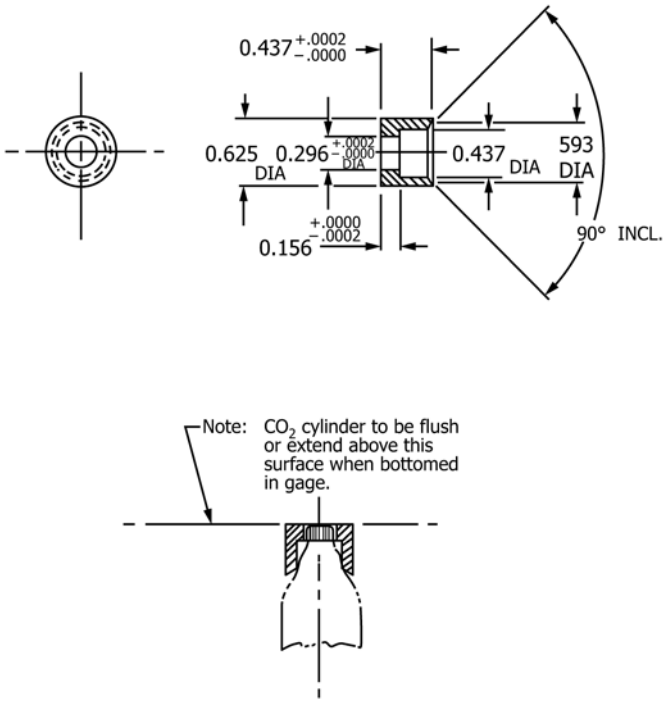
7.7.5.4 Repeat 7.7.5.1 – 7.7.5.3 for all cylinders to be tested.

7.8 *CO_2 Cylinder Non-Refillable Rupture Test:*

7.8.1 *Significance*—The purpose of this test method is to rupture a sample lot of CO_2 cylinders that have passed the test described in 7.6 by elevating the temperature until rupture occurs. This will test for the type of rupture of the cylinder.

7.8.2 *Apparatus:*

7.8.2.1 *Scale,* having an accuracy of ±0.1 g to measure the weight of a CO_2 cylinder.



Neck Size	Dimension A, in. (mm)
Small	0.296 + 0.0002, –0.0000 (7.52 + 0.005, –0.000)

FIG. 8 Ring Gage for CO_2 Cylinder Non-Refillable Maximum Neck Diameter and Minimum Neck Length (Small Neck Cylinders)

7.8.2.2 *Heating Device,* with an accuracy of ±5°F (±2.8°C) adjustable to a temperature range of 150 to 300°F (66 to 149°C) and capable of withstanding damage from a CO_2 cylinder that may rupture during the test.

7.8.3 *Test Specimen*—Test specimens shall consist of samples described in 7.6.

7.8.4 *Procedure:*

7.8.4.1 Obtain cylinders from a batch tested in accordance with the manufacturer's usual quality control practice. Select cylinders at the high weight limit for CO_2 cylinders.

7.8.4.2 Place one CO_2 cylinder in the test device in such a way that it can be fully exposed to the heat of the device.

7.8.4.3 The CO_2 cylinder shall be ruptured by gradually raising the temperature of the heating device. There shall be no splintering or fragmentation of the cylinder or any failure of the cap or neck section when the cylinders are ruptured.

8. General Considerations for Transfilling and Safe Handling of Removable CO_2 Cylinders Re-fillable

8.1 *General Considerations:*

8.1.1 Persons transfilling carbon dioxide (CO_2) must be trained in the hazards associated with liquid carbon dioxide. Contact between exposed skin and cold piping or carbon dioxide can cause frost burns or present other hazardous situations.

8.1.2 Always wear heavy gloves and eye protection while filling cylinders.

8.1.3 Always have the MSDS at the re-filling location.

8.1.4 Always read and understand fill stations instructions.

8.1.5 Ensure that there is proper ventilation in the filling area.

8.1.6 Warning posters should be posted near the filling operation. These shall be of appropriate size and posed in a clearly visible location.

8.1.7 The receiving cylinder must be of a refillable type (that is, not disposable) and the net weight or volume of gas that it can safely hold stamped or marked on the cylinder.

8.1.8 Supply cylinders must be secured and supported, such as fastened to a wall or similar immovable structure (that is, not free standing).

8.1.9 It is recommended that a siphon type bulk CO_2 tank be used for filling.

8.1.10 Warning signs should be placed at the entrance of the filling area where high concentrations of carbon dioxide gas can accumulate. These shall be of appropriate size and posted in a clearly visible location.

8.2 *CO_2 Fill Station:*

8.2.1 CO_2 fill stations and related equipment should be rated to at least 1800 psi working pressure.

8.2.2 The transfer hose shall be compatible with liquid CO_2 and shall have a minimum service pressure of 3000 psi.

8.2.3 Fill stations shall be supplied with instructions for operation by the manufacturer or distributor of the product.

8.2.4 Fill stations should have warnings posted:

8.2.4.1 Read owner's manual before using.

8.2.4.2 Use only with CO_2.

8.2.4.3 Close bulk tank valve when not in use.

8.2.4.4 Vent down system.

8.3 *CO_2 Cylinder Inspection:*

8.3.1 Conduct a valve twist test as described in 3.1.15 on empty CO_2 cylinders to determine if the valve is securely attached to the cylinder. Any cylinders which have valves that can be twisted by hand, or which show signs of the valve having been partially removed, must not be filled. These valves must be repaired by the manufacturer or its authorized representative prior to using the cylinder.

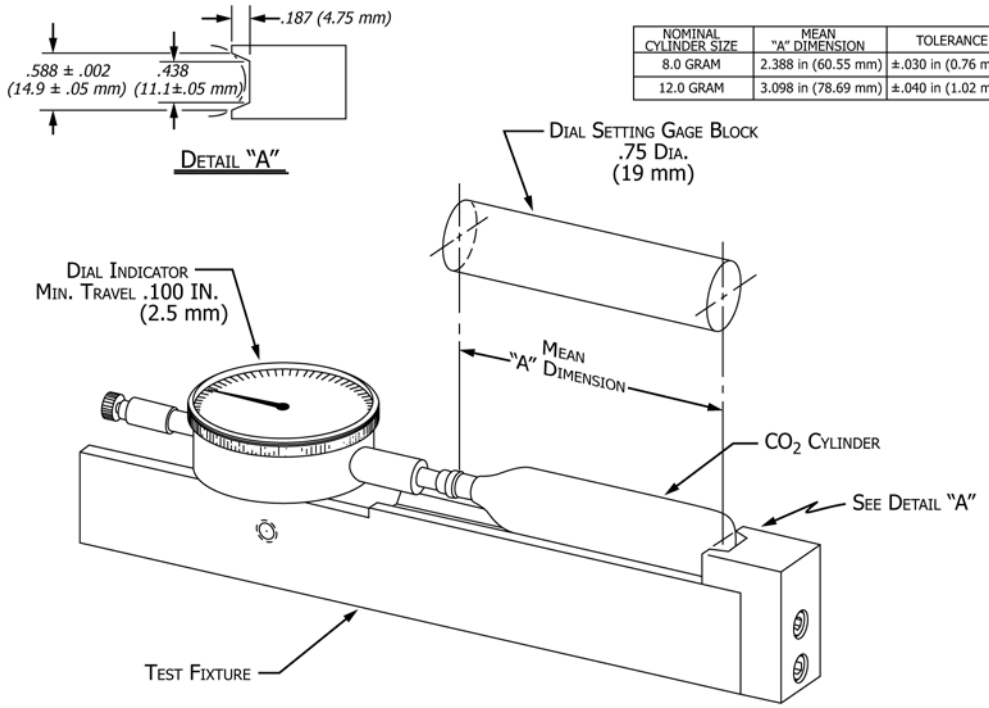
8.3.2 User may mark a rotation indication mark between the tank and bottle. Ensure the line matches between the two pieces. If the line does not match, do not fill the cylinder. If no line is present, place a non-removable (that is, paint pen), non-etching marking between the valve and bottle for future reference.

8.3.3 Visually inspect each cylinder's condition before each fill. Cylinders must be in good condition: free of large dents, scrapes, bulges, obvious corrosion, pits, or evidence of fire damage and leaks. Cylinders should not be buffed or polished.

8.3.4 Cylinders must be stamped with a DOT (Department of Transportation) or a TC (Transport Canada) mark, working pressure, manufacturer's code or name, serial number, hydrostatic test date and rated CO_2 capacity. If no stamping is present or stamping has been altered or is non-legible, do not fill or use the cylinder.

8.3.5 Cylinder valves must have a rupture disk or pressure relief mechanism.

8.3.6 Pressure relief or rupture disk assembly should be tight and all pressure relief passages should be clear of obstructions.



Nominal Cylinder Size	Mean "A" Dimension, in. (mm)	Tolerance, in. (mm)
8.0-g	2.388 (60.55)	±0.030 (0.76)
12.0-g	3.098 (78.69)	±0.040 (1.02)

FIG. 9 CO_2 Cylinder Non-Refillable Length, Cap to 0.588 Datum Gage

8.3.7 Cylinder must have correct 3000 psi (3K) burst disk as per ASTM F2030; 3AL-1800.

8.3.8 Valve and external threading must not be damaged and must be free of foreign material. The valve-ring must be in good condition. Damaged valves or components must be cleaned or repaired by the manufacturer or its authorized representative prior to filling the cylinder.

8.3.9 Cylinders must not be filled if any of the following conditions exists:

8.3.9.1 The valid test date range for the cylinder has been exceeded. Requalification period for 3 AL aluminum as well as 3A and 3AA steel cylinders is five (5) years. There is no maximum life for 3 AL, 3A, 3AA and 3E cylinders as long as the cylinder passes visual and hydrostatic inspections. Cylinders conforming to Sec.180.209, DOT 3E are exempt.

8.3.9.2 Aluminum cylinders not exceeding 5 cm (2-in.) outside diameter and less than 61 cm (2 ft) in length are exempt from hydrostatic retesting.

8.3.9.3 Presence of water or other liquids in the cylinder.

8.3.9.4 Evidence of internal contamination such as rust or other particles.

8.3.9.5 External corrosion exceeding 0.8 mm (0.032 in.) in depth or 25 % of surface area.

8.3.9.6 Dents in aluminum bottles that exceed 1.6 mm (0.062 in.) with a diameter less than 50.8 mm (2 in.).

8.3.9.7 Dents in steel bottles that exceed 1.6 mm (0.062 in.) with a diameter less than 10 times the depth of the dent.

8.3.9.8 Scrapes or gouges that decrease the wall thickness of the cylinder.

8.3.9.9 Visible bulges.

8.3.9.10 Evidence of polishing, buffing, welding, grinding, sandblasting, plating or exposure to high temperature over 350°F.

8.3.9.11 Exhibition of any other condition that would indicate the cylinder to be unsafe to use.

8.4 *CO_2 Cylinder Fill Procedures:*

8.4.1 The safety relief device, cylinder wall and valve body assembly of the cylinder to be transfilled must be inspected as described in 8.3.

8.4.2 CO_2 should only be filled by weight, never pressure.

8.4.3 If so equipped, close the valve on the CO_2 cylinder.

8.4.4 Attach the CO_2 fill station to the supply cylinder. Ensure that the CGA 320 fitting is used and installed correctly. Ensure that only one (1) correct sealing washer is used.

8.4.5 Deactivate the universal fill adaptor (UFA). Attach the cylinder to the CO_2 fill station using the UFA.

8.4.5.1 Invert the cylinder. Open the cylinder valve and/or activate the UFA and the blow-down valve to fully discharge the remaining CO_2.

8.4.5.2 Weigh the empty cylinder. Determine the allowable net weight of CO_2 and add this value to the empty cylinder weight. This provides the gross weight of the full cylinder. The cylinder should be cool to the touch in order to receive the CO_2.

8.4.5.3 If no venting occurs, add 1 to 2 oz of CO_2 and repeat the inversion and depressurization.

8.5 Fill the cylinder to the proper gross weight.

8.5.1 To fill the cylinder, open the valve to the cylinder, activate the UFA, close the blow-down valve, and open the supply valve to begin transfer of the CO_2.

8.6 To complete the transfilling process, close the supply valve, de-activate the UFA and the valve of the cylinder and open the blow-down valve to vent the supply line. Check the final weight of the cylinder.

8.7 If the final weight is below the allowable gross weight of the cylinder, close the transfer valve, open the blow-down valve to relieve some pressure from the cylinder and repeat steps above for filling.

8.8 If the final weight exceeds the allowable gross weight of the cylinder, vent the excess CO_2. Do not overfill the cylinder.

8.9 Turn off the supply tank, safely vent down the fill station and, if possible, remove or secure any hoses. Do not leave CO_2 in the fill station or hoses when not in use.

9. Instructions and Warnings

9.1 *Projectiles*—Individual packages containing non-powder gun projectiles shall include the following warning as a minimum:

⚠ **WARNING:** Air guns are not toys. Misuse or careless use may cause serious injury or death.
Be careful—Shoot safely.

9.2 *CO_2 Cylinders, Non-Refillable:*

9.2.1 All CO_2 cylinders and intermediate containers for CO_2 cylinders shall contain appropriate instructions or warnings, or both, communicating to the user the proper method of usage. These instructions or warnings, or both, shall include as a minimum:

Caution: (amount of gas in grams) CO_2 gas under pressure. Do not mutilate or heat above 140°F (60°C).

9.2.2 If the CO_2 gas is not for human consumption, the instructions or warnings, or both, shall so indicate.

9.2.3 Individual packages containing CO_2 cylinders shall include the following warning:

⚠ **WARNING:** Air guns are not toys. Misuse or careless use may cause serious injury or death.
Be careful—Shoot safely.

10. Product Identification and Marking

10.1 *Projectile*—The type, material used, and caliber of the projectile shall be identified on the packaging for the projectile and shall be specifically marked as follows:

10.1.1 *Air-Gun Shot, Lead*—Identify as "lead, air-gun shot, ( )[3] cal."

10.1.2 *Air-Gun Shot, Lead-coated*—Identify as "lead-coated, steel air-gun shot, ( )[3] cal."

10.1.3 *Air-Gun Shot, Steel*—Identify as "steel, air-gun shot, ( )[3] cal."

10.1.4 *Air-Gun Shot, Other*—Identify as "other material, air-gun shot, ( )[3] cal."

NOTE 5—Insert appropriate material type as applicable.

10.1.5 *Pellet*—Identify as "lead air-gun pellet, ( )[3] cal."

10.1.6 *Pellet*—Identify as "other material air-gun pellet, ( )[3] cal."

NOTE 6—Insert appropriate material type as applicable.

10.1.7 *Air-Gun Dart*—Identify as "steel, air-gun dart, ( )[3] cal."

NOTE 7—If an alternative material is used in the manufacture of this projectile, the applicable material should be specified on the package.

10.1.8 Caliber size shall be marked as follows in both U.S. customary and SI units, except that .177 cal air-gun shot, steel shall be marked "BB cal".

BB cal (4.5 mm)
.177 cal (4.5 mm)
5.0 mm (.20 cal)
.22 cal (5.5 mm)
.25 cal (6.4 mm)

10.1.9 The protective finish used on the projectiles shall be indicated.

10.2 *Propellant, Refillable Removable*—The cylinder shall be stamped with a DOT (Department of Transportation) or a TC (Transport Canada) mark, working pressure, manufacturer's code or name, serial number, hydrostatic test date and rated CO_2 capacity.

10.3 *Propellant, Refillable Non-Removable*—The owner's manual shall include information regarding the working pressure, capacity and recommended filling instructions related to the recommended gas or gases used in the reservoir.

10.4 *Propellant, Non-refillable (also known as CO_2 Cylinders, Non-Refillable)*—Cylinder shall be identified as "standard neck" or "small neck" (see Table 9).

11. Keywords

11.1 air-gun; CO_2 cylinder non-refillable; dart; non-powdered gun projectile; pellet; propellents; shot

[3] Insert appropriate caliber, as applicable.