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An American National Standard

Standard Practice for Transfilling and Safe Handling of Small CO_2 Cylinders for Use in Paintball[1]

This standard is issued under the fixed designation F2856; 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 practice is intended to satisfy the demand for information on the basic procedures for the safe handling and transfilling of small (not bulk) paintball CO_2 cylinders commonly used with a paintball marker for propulsion of a paintball. This standard does not address issues dealing with the transfilling, storage, and handling of supply cylinders that may be used in transfilling smaller cylinders.

1.2 The CO_2 fill procedures are written for the pressure cycling cylinder transfilling method most commonly used by paintball field and/or store operators.

1.3 This practice should not be confused with federal, state, provincial, or municipal specifications or regulations; insurance requirements; or national safety codes.

1.4 *This practice does not purport to address all of the safety problems, if any, associated with the safe handling and transfilling of small paintball 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 and not limited to DOT, CGA, and OSHA, prior to use.*

2. Referenced Documents

2.1 *ASTM Standards:*[2]

F1979 Specification for Paintballs Used in the Sport of Paintball

F2030 Specification for Paintball Cylinder Burst Disk Assemblies

F2553 Specification for Warnings on Refillable CO_2 Cylinders Used In the Sport of Paintball

2.2 *CGA Standards:*[3]

CGA G-6.3 Carbon Dioxide Cylinder Filling and Handling Procedures

CGA C-6-2005 Standards for visual inspection of steel compressed gas cylinders

CGA C-6.1 – 2006 Standards for visual inspection of high pressure aluminum compressed gas cylinders

CGA G-6.8 – 2007 Transfilling and safe handling of small carbon dioxide cylinders

TB-14 Torque Guidelines For Sealing CGA Valve Outlet Connections

2.3 *Other Standards:*

CFR 49 Parts 100 to 185 [4]

3. Terminology

3.1 *Definitions of Terms Specific to This Standard:*

3.1.1 *authorized retester, n*—facility registered with and approved by DOT for the requalification of cylinders.

3.1.2 *blow-down valve, n*—valve which is part of a fill station assembly, and which is intended to vent gas from the paintball cylinder and fill station being filled.

3.1.3 *fill station, n*—device designed to attach to a supply cylinder and to a paintball cylinder, which facilitates transfilling the paintball cylinder.

3.1.4 *paintball, n*—spherical ball, commonly with a diameter of 17.3 mm (0.68 in.), comprised of a shell and a fill, designed to be expelled from a paintball marker and conforming to Specification F1979.

3.1.5 *valve twist test, n*—test done by hand where as the user grasp 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).

3.1.5.1 *Discussion*—If the valve does move, the valve and bottle should not be filled and should be repaired and/or serviced by the manufacturer or its authorized representative. If the valve does not move then the valve passes the test and may

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

[3] Available from Compressed Gas Association, 4221 Walney Road, 5th Floor, Chantilly, VA 20151.

[4] Available from U.S. Government Printing Office Superintendent of Documents, 732 N. Capitol St., NW, Mail Stop: SDE, Washington, DC 20401, http://www.access.gpo.gov.

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

3.2 *Acronyms:*

3.2.1 *DOT*—department of transportation

3.2.2 *RIN*—retester identification number

3.2.3 *TC*—transport Canada

4. General Considerations

4.1 Persons, who are 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 can present other hazardous situations.

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

4.3 Always have the MSDS at the location that the filling takes place.

4.4 Always read and understand all fill station instructions.

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

4.6 Warning posters should be posted near the filling operation. These shall be of appropriate size and posted in a clearly visible location. See Fig. 1 and Fig. 2.

4.7 The receiving cylinder (paintball 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 on the shoulder or marked on the cylinder.

FIG. 1 Example of Warning Poster A

FIG. 2 Example of Warning Poster B

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

4.9 It is recommended that siphon type bulk tank be used for filling. Avoid using inverted bulk tanks unless done properly, as shown in CGA G-6.8.

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

5. Fill Stations

5.1 Fill stations and related equipment should be rated to at least 1800 psi working pressure.

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

5.3 Fill stations shall be supplied with instructions for operation by the manufacturer or distributor of the product. See Fig. 3 and Fig. 4.

FIG. 3 Example of Fill Station Instruction Sheet A

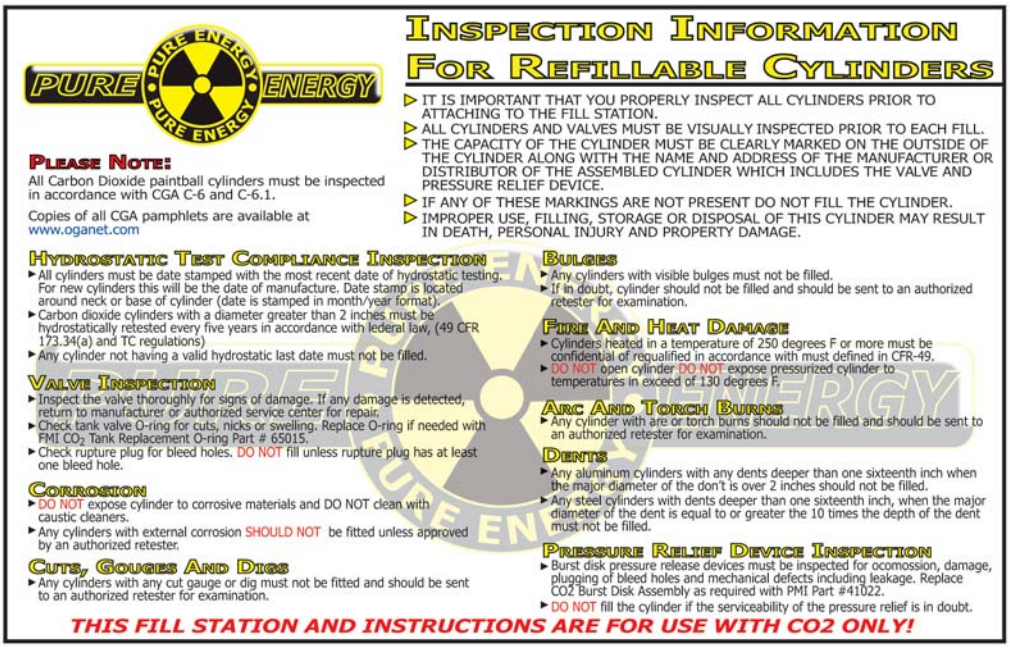

FIG. 4 Example of Fill Station Instruction Sheet B

5.4 Fill stations should be marked or tagged with the following safety warnings:

5.4.1 Read owners manual before using.

5.4.2 Use only with CO_2.

5.4.3 Close bulk tank valve when not in use.

5.4.4 Vent down system.

6. Cylinder Inspection

6.1 Conduct a valve twist test on empty 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. The owners of such cylinders should be

warned to have the valve repaired by the manufacturer or its authorized representative, prior to using the cylinder or attaching it to a marker. See Fig. 5.

6.2 Look for a rotation indication mark between valve and bottle. Ensure line matches between two pieces. IF THE LINE DOES NOT MATCH DO NOT FILL THE CYLINDER. See Fig. 6.

6.3 If no line is present place a non removable, non etching marking between the valve and bottle for future checks. A paint pen is a good item to use to apply the rotation indication mark.

6.4 Visually inspect the cylinder condition before each fill.

6.4.1 Cylinders must be stamped on the shoulder with a DOT (Department of Transportation) and potentially 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 non legible, do not use the cylinder. See Fig. 7.

6.4.2 The pressure rating stamped on the cylinder must be at least 1800 psi.

6.4.3 Cylinders must be in good condition: free of stickers, large dents, scrapes, bulges, obvious corrosion, pits, evidence of fire damage and leaks.

6.4.4 Cylinders should not be buffed or polished.

6.4.5 Cylinders having valves without a rupture disk or pressure relief mechanism must not be filled.

6.4.6 Pressure relief or rupture disk assembly should be tight, and all pressure relief passages should be clear of obstructions. See Fig. 8.

6.4.6.1 Cylinders must have correct burst disk as per Specification F2030; 3AL-1800 CO_2 cylinders require a 3000 psi (3K) burst disk.

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

6.5 Cylinders must NOT be filled if any one of the following conditions exists:

6.5.1 Cylinders are outside the valid test date range.

6.5.1.1 Requalification period for CO_2 cylinders used in paintball is five (5) years for 3AL aluminum and 3A and 3AA steel bottles. There is no maximum life for a 3AL, 3A, and 3AA cylinders as long as the cylinder passes visual and hydrostatic inspections.

FIG. 5 Warning Label From Specification F2553.

FIG. 6 Valve/Cylinder Rotation Indicator Marking

DOT – 3AL 1800 M4625 04^03 8 oz CO_2 A051391
This cylinder layline of data breaks down like this:
DOT – Department of Transportation (a Federal Agency)
3AL – the specification standard the cylinder conforms to
1800 – the working pressure rating of the cylinder
M4625 – the manufacturer of the cylinder
04^03 – The hydrostatic test date of the cylinder
The first two digits are the month
The ^ is the testing agency mark
The last two digits are the year
The above date would be valid to use until April 1, 2008
8oz CO_2 – The amount of CO_2 the cylinder is rated to hold
A051391 – The serial number of the tank

After hydrostatic testing the retest date will look like this:
Stamped on shoulder
G 7
04 5 6 07
The first two digits are the month
The G 7 is the re-testing agency RIN (Re-tester ID #)
5 6
The RIN number is read in a clock wise direction, G765
Contact D.O.T. for RIN information

The last two digits are the year
The above date would be valid to use until April 1, 2012

FIG. 7 Cylinder Stamping

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

6.5.3 Presence of water or other liquids in the cylinder.

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

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

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

FIG. 8 Pin Valve Showing Burst Disk Assembly

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

6.5.8 Scrapes or gouges that decrease the wall thickness of a cylinder.

6.5.9 Visible bulges.

6.5.10 Cylinders show evidence of polishing, buffing, welding, grinding, sandblasting, plating, or exposure to high temperature over 350°F.

6.5.11 Any other condition that seems unsafe to use should not be filled and should be inspected by a certified DOT authorized re-tester.

7. CO_2 Fill Procedures

7.1 The safety relief device, cylinder wall, and valve body assembly of all cylinders to be transfilled must be inspected as described in Section 6. If a condition not described in Section 6 is found and is of concern of the person transfilling the cylinder, the cylinder must not be filled.

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

7.3 If so equipped, close the valve on the paintball cylinder.

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

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

7.5.1 Invert the paintball cylinder, open paintball cylinder valve and/or activate the UFA and the blow-down valve to fully discharge the remaining CO_2.

7.5.2 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 a full cylinder. The bottle should be cool to the touch in order to receive the CO_2.

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

7.5.4 Conduct a valve twist test on the depressurized cylinder as stated in 6.1 and 6.2.

7.6 Fill the cylinder to the proper gross weight.

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

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

7.8 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 paintball cylinder and repeat steps above for filling.

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

7.10 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.

8. Keywords

8.1 carbon dioxide; CO_2; compressed gas; cylinders; liquefied; paintball; pressure vessel; rupture disk; transfilling