



## Dangers of Overfilling CO<sub>2</sub> Paintball Cylinders

Overfilling a CO<sub>2</sub> cylinder, be it an attempt to get longer service out of one charge of a cylinder or be it accidental, can have unexpected and even catastrophic consequences due to the expansion characteristics of the CO<sub>2</sub> charge.

We at Catalina Cylinders have heard many times that it is not fair that a CO<sub>2</sub> cylinder is deemed full at only 68% of its water capacity, that there appears to be 32% of its water capacity that is not being used, or wasted, and that this capacity not being used could be used for extended service life of one CO<sub>2</sub> charge. This 32% is not spare, or wasted, capacity. Following are three situations that identify why this 32% of the total water capacity of a CO<sub>2</sub> cylinder is not spare, or wasted, capacity.

### 1. A 20-ounce CO<sub>2</sub> paintball cylinder with a full charge (68% of its water capacity)

When a fully charged, 68% full by water capacity, 20 ounce CO<sub>2</sub> cylinder warms up to room temperature (70°F), the pressure inside the cylinder is 837 psi. When the cylinder reaches 87.9°F the entire charge becomes a gas no matter what the pressure. A fully charged CO<sub>2</sub> cylinder at 87.9°F will have an internal pressure of approximately 1100 psi. At 120°F a fully charged CO<sub>2</sub> cylinder will have an internal pressure of nearly 2000 psi, this is greater than the designed service pressure of 1800 psi of the cylinder. Remember that this cylinder at 120°F has an internal pressure greater than the marked service pressure of the cylinder and is properly filled, not overfilled. Also note that 120°F is not an excess temperature and can quite easily be reached in many different environments (i.e. in a shed or a vehicle on a hot day or in a kitchen).

### 2. A 20-ounce CO<sub>2</sub> paintball cylinder with a 5 ounce overfill (85% of its water capacity)

The following would occur if a 20 ounce CO<sub>2</sub> cylinder were slightly overfilled with 25 ounces of CO<sub>2</sub> charge to increase its service life between fills. When the cylinder and charge warm to room temperature the internal pressure of the cylinder would be 1430 psi. If the cylinder were warmed to 103°F the cylinder would vent through the safety device of the valve. This venting would most likely be unexpected since it would not be known when the cylinder would warm to 103°F. Unexpected venting through the safety device of a valve has caused property damage and personal injury.

### 3. A 20-ounce CO<sub>2</sub> paintball cylinder greatly overfilled (95% of its water capacity)

A 20 ounce CO<sub>2</sub> cylinder filled to 95% of its capacity, not quite liquid full, would vent through its safety prior to the cylinder reaching room temperature, 70°F. If the safety disc has been altered and reinforced and would not actuate, the cylinder would rupture between 85<sup>o</sup>-95<sup>o</sup>F. Rupturing cylinders have caused severe property damage and serious personal injury, even loss of life.

Accidental overfilling or overfilling due to inaccurate equipment (i.e. the scale being used in the filling process not being calibrated or not being able to measure in small enough units of measure to accurately fill small cylinders) will have the same results as purposely overfilling a cylinder. The effects of accidental overfilling of a small CO<sub>2</sub> cylinder can have catastrophic effects as described below.

A 7-ounce CO<sub>2</sub> cylinder filled accidentally with 2.8 extra ounces of CO<sub>2</sub> will be filled to 95% of its capacity. As stated above, a cylinder filled to 95% of its water capacity would vent through its safety device before the cylinder warms to room temperature.

In summary, never overfill a CO<sub>2</sub> cylinder, on purpose or accidentally. The affects of overfilling coupled with the effects of increasing temperature on the CO<sub>2</sub> charge, will greatly increase the probability that something catastrophic could happen to property or personnel. Do not take the risk. Do not overfill a CO<sub>2</sub> cylinder.