Working with High Pressure Air

I. Safe Storage and Transport

For long-term storage, cylinders should be pressurized to no more than several hundred psig, have the Valve outlet capped and stored upright in a cool, dry location. During transport cylinders should be safely secured and protected from extreme temperatures.

CGA (Compressed Gas Association) standards require that aluminum cylinders exposed to temperatures over 350^0 F be condemned.

II. Periodic Visual Inspection

Regularly inspect cylinders and valves for physical damage such as cuts, gouges or dents, signs of heat damage and general abuse. An annual inspection should be performed during which the Valve is removed and the Cylinder and Valve checked for internal contaminants and thread integrity (no signs of cracking or deterioration). Cylinders that show evidence of physical damage should be hydrostatically tested prior to refilling. Valves that show evidence of damage should be discarded.

Valves that are contaminated or exhibit abnormal operating performance characteristics should be disassembled, cleaned and rebuilt using CAS service package components.

III. Threads and Fittings

Be sure fittings and connection threads meet properly - never force. All fittings and hoses must be in good working condition and free of debris and oil. Never use thread sealant (Teflon paste, Teflon tape, etc,) on any CAS fittings except for the small pipe thread fittings used in pressure compensation and actuator lines.

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Do not attempt to use fittings anywhere in the system other than those supplied by CAS. The high pressure fittings used are designed to meet the working pressure requirements of the system. The medium pressure lines are designed to not only meet the working pressure requirements of the system but also yield the minimum pressure drop possible, to maximize system performance.

IV. Hydrostatic Testing

According to Department of Transportation regulations, all compressed gas cylinders pressurized to more than 900 psi must be hydrostatically tested every five years to verify their structural integrity. These tests typically involve filling the cylinder with water, placing it in a water-filled pressure chamber, and measuring the expansion of the cylinder as pressure is applied. Hydrostatic test pressures vary depending on the cylinder material, but they typically are performed at 1.5 to 1.66 times the cylinders service pressure. If the permanent expansion of a cylinder is 10 percent or more, the cylinder is condemned and removed from service.

Any time a cylinder sustains physical damage or is exposed to high temperatures, the integrity of the cylinder is suspect, and a hydrostatic testing is warranted. When a cylinder passes a hydrostatic test, new markings are stamped into the crown of the cylinder to indicate the test date.

V. Emptying Contents

High pressure (upstream of the Mechanical Regulator) lines and fittings should never be loosened or removed while the system is pressurized. Always shut the Cylinder's Valve and completely vent the systems pressure using the Schrader valve in the Mechanical Regulators outlet fitting prior to disconnecting high pressure hoses or fittings.

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VI. Cylinder Filling

Regardless of the type and size of cylinder, it's important to get a good (and safe) air fill. The first thing to make certain of is that the technician filling your cylinder knows the correct cylinder pressure. We have firsthand experience with a scuba shop employee filling three 3290 psig type III composite cylinders to 4300^{+} psig, not realizing what had happened until all three cylinder's PRD's vented while they were sitting in the back of a vehicle when exposed to ambient temperature of 120^{0} F.

The service pressure rating for cylinders assumes a temperature of 70^{0} F. The ideal gas law dictates that the pressure in the cylinder will rise or fall about 1% for every 10^{0} F change in temperature of the cylinder's contents.

Make certain your cylinder is being filled with standard breathable air, not high oxygen content blends such as Nytrox. Elevated oxygen contents lead to greatly increased flame temperatures and massive engine damage.

Air quality is a potential concern. Only fill cylinders using air from a trusted supply source. Before connecting the fill line, the connector should be either blown or wiped dry.

A maximum fill rate of 300-600 psi per minute is typically recommended to prevent excessive heating during the fill, regardless of whether the cylinder is filled while in a H2O immersion tank or merely in ambient air.

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VII. Cylinder Markings/Coding

CAS cylinders are marked with stamped coding in the neck area:

- The first group of letters "TC-3ALM 234" is a designation denoting the cylinder is in aluminum and is in compliance with Canadian transport regulations.
- The second group of letters (DOT3AL-3400) denotes that the cylinders are manufactured in the US; DOT stands for US Department of Transportation, 3AL denotes aluminum and 3400 is the maximum service pressure (3400 psig).
- The third grouping of letters, which is typically on the same line as the second group lists the cylinder's serial number, manufacturer and manufacturing date. The manufacturing date is listed by month & year, for example: "01A07" was manufactured in January 2007.

Cylinders must be hydrostatically tested every five years to ensure that they are structurally sound. Each time a cylinder is hydrostatically tested, a new month and year is added to the markings, separated by a unique symbol designating the independent inspection agency (IIA) performing the test.