

# **Equipment Alert -- January 25, 2011**

## **Catastrophic Failure Of An Oxygen Cylinder Fitting In A Refuge Alternative**

### **Incident Summary**

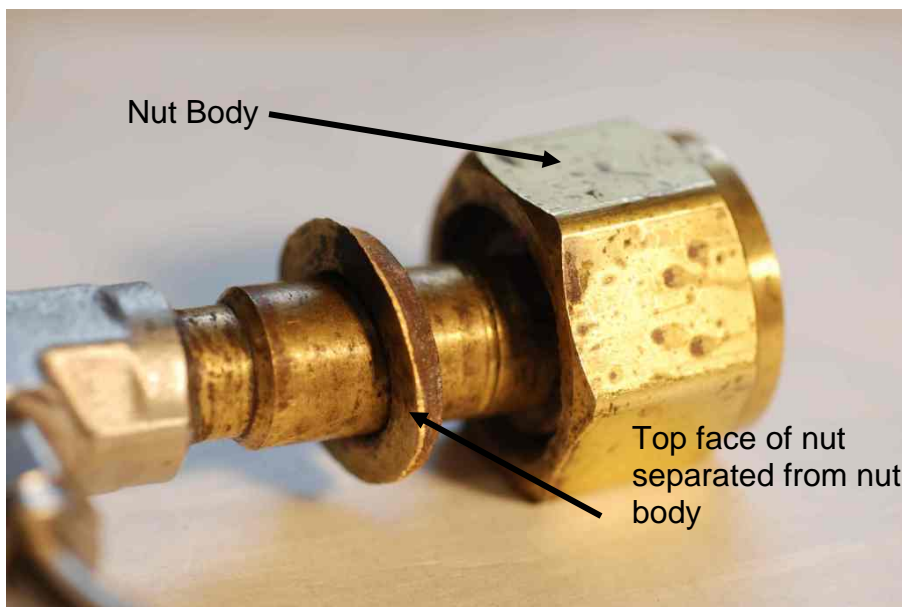
On Sunday, January 9, 2011, a catastrophic failure occurred in an oxygen cylinder fitting connected to the breathable air system in a refuge alternative located in an underground coal mine. The refuge alternative was an inflatable tent design manufactured by the A.L. Lee Corporation, model number 4042-35 manufactured on March 21, 2008. This refuge alternative is equipped with 12 high pressure oxygen cylinders, each pressurized at 4,500 psi. The manufacturer of the failed high pressure fitting is unknown at this time. Once the fitting manufacturer is identified, this alert will be updated with this information.

On the day of the incident, the refuge alternative had been examined during the required pre-shift examination, and no defects were identified. Approximately two and one-half hours later, a scoop operator discovered debris scattered on the mine floor near the refuge alternative.

The refuge alternative manufacturer, state inspectors, and MSHA examined the refuge alternative to determine the cause of the incident. The preliminary findings indicate there was a catastrophic failure of a brass high pressure fitting connected to an oxygen cylinder valve. Photograph 1 (below) shows the separation of the top face of the nut from the nut body.

This catastrophic failure allowed a rapid release of oxygen, which pressurized the interior of the steel structure. The initial determination is that the pressure build-up inside the container forced open both the tent deployment door and the air-lock access door, ejecting a supply container and three 5-gallon water containers from the access door area onto a nearby rib.

Photograph 1



## **Preliminary Investigation Findings**

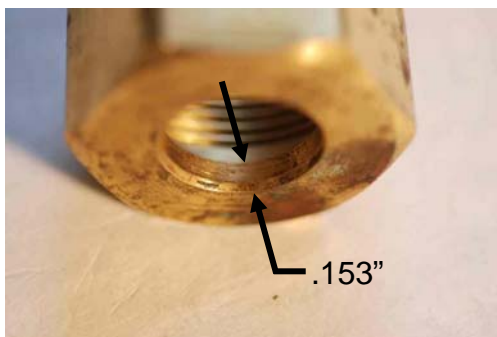
Further examination of the high pressure oxygen fittings revealed that some of the fittings used in the refuge alternative did not meet the applicable Compressed Gas Association (CGA) standard. Although the fittings had markings that indicated “CGA 701” (photograph 2), the examination revealed that the hexagon nut wall thicknesses did not meet CGA specifications, as the nut walls were approximately 40% thinner (.097 inches) than the required .250-inch minimum wall thickness (photograph 3 & 4). Also, the hexagon nuts were approximately 8% shorter (.091 inches) than the CGA-required 1.125-inch minimum length (shown upright in photograph 5).

Photograph 2



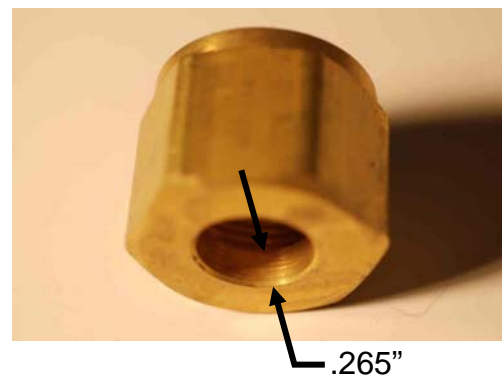
CGA designation on high pressure fitting (nut)

Photograph 3



Measured wall thickness on non-compliant high pressure fitting (nut)

Photograph 4



Measured wall thickness on CGA compliant high pressure fitting (nut)

Photograph 5



Measured length (shown upright) on non-compliant and CGA compliant high pressure fitting (nut)

MSHA will continue to examine the refuge alternative components and will investigate a report of a second, very recently discovered incident to determine if additional factors contributed to the high pressure fitting catastrophic failure. MSHA will distribute additional information as necessary based on any subsequent investigation findings.

### **Recommended Actions**

1. All refuge alternatives should be physically examined to ensure correct fittings are installed on compressed gas systems. Operators should contact the refuge alternative manufacturer to assist in the examinations. The operator should ensure that the refuge alternative manufacturer performs all necessary repairs to the refuge alternative. The examination should include removing access doors, if necessary, to measure and examine each fitting to verify compliance with the applicable CGA standard. The examination may require removal of fittings to take necessary measurements.

A fitting identified with a CGA standard number does not guarantee that the fitting complies with the CGA standard. The fittings should be physically examined to verify compliance.

**As the refuge alternative may not be available for use during examination and/or repair, persons should not be located in by the refuge alternative during any underground examination and repair.**

**Mine operators should work with the manufacturer to assure that examination and any necessary repairs are completed promptly.**

2. Operators should request the refuge alternative manufacturer to verify that the fittings meet the appropriate Compressed Gas Association (CGA) standard.

2a. Operators should request that the refuge alternative manufacturer verify that the CGA standard pressure range corresponds with the pressurized gas system within the refuge shelter.

For example: CGA standard “**Connection No. 701**” is used for standard cylinder valve outlet connections for pressures ranging from 4,001 to 5,500 psig on compressed **oxygen** systems. CGA standard “**Connection No. 347**” is used for standard cylinder valve outlet connections for pressures ranging from 3,001 to 5,500 psig on compressed **air** systems.

3. Leak detection fluids containing ammonia must not be used for inspection of air and oxygen systems. Only leak detection fluids approved for use with air and oxygen systems may be used to check for leaks. Operators should instruct the refuge alternative manufacturer to inspect the refuge alternative’s fittings for corrosion during any manufacturer’s examination.
4. Records reflecting any modifications or repairs to a refuge alternative must be recorded pursuant to 30 C.F.R. § 75.1508(b).
5. CGA standards can be purchased from the Compressed Gas Association.

**CGA Contact Information:**

**Website Address**

<http://www.cganet.com/>

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**Mailing Address**

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Chantilly, VA 20151

**Fax**

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