



STEIGERWALT ASSOCIATES, INC.

1121 South 24th Street • Allentown, PA 18103 • TEL (610) 437-1704 • FAX (610) 437-4545

SAFETY ADVISORY – DOT 3AL CYLINDERS - FINAL RULE EFFECTIVE 1/1/2007 **EDDY CURRENT TESTING 6351 3AL CYLINDERS**

- APPLIES ONLY TO SCBA, SCUBA & OXYGEN CYLINDERS MADE FROM 6351: THERE IS NO METALLURGICAL EVIDENCE AT THIS TIME THAT 6061 ALLOY IS SUBJECT TO SLC – SUSTAINED LOAD CRACKING. IT IS BELIEVED THAT EVENTUALLY ALL 6351 CYLINDERS WILL DEVELOP CRACKS - MILLIONS HAVE BEEN SCRAPPED WORLDWIDE AND THE ALLOY HAS BEEN BANNED FOR GAS CYLINDERS
- NO OTHER GASES --- CO2 DOES NOT REQUIRE EDDY-CURRENT TEST
- LUXFER AND KIDDE BEFORE 1990 -- QUESTIONS & GUIDANCE: CALL THE CYLINDER MAKER; MANUFACTURER & DOT WEB SITES, DOT SAFETY ADVISORY NOTICE 94-7, FEDERAL REGISTER JULY 26, 1994
- NO CATALINA OR HY-MARK CYLINDERS WERE MADE FROM 6351
- CGA 6.1-2002: ALL DOT 3AL CYLINDERS REQUIRE LIGHT & MIRROR INTERNAL INSPECTION -- ALL 3AL's [EXCEPT 6061 INSPECTED BY UE] – WE RECOMMEND "OPTICAL PLUS" FOR THE THREAD INSPECTION
- REGULATIONS – APPENDIX C, PART 180 - EXPLAIN PRECISELY WHAT MUST BE ON YOUR RECORD KEEPING FORM FOR BOTH EDDY CURRENT TESTING & CALIBRATION OF THE TESTER.
- DISREGARD DOT ACCEPTANCE CRITERIA – TWO CRACKED NECK THREADS IF YOU SEE ANY EVIDENCE OF CRACKING ANYWHERE IN THE THREADS OR HEAD - CONDEMN THE CYLINDER.
- WARNING: THERE IS NO WAY TO KNOW HOW MUCH CRACKING IS IN THE TOP/ SHOULDER/ HEAD OF THE CYLINDER BY THE TIME CRACKING IS VISIBLE IN THE THREADS
- LIKE HAZMAT TRAINING - THE HAZMAT EMPLOYER [RIN HOLDER] IS RESPONSIBLE FOR THE TRAINING & COMPETENCE OF THEIR EMPLOYEES. NO ONE "CERTIFIED" OR APPROVED BY DOT AS AN EDDY CURRENT "CERTIFIER" – YOU CAN SELF CERTIFY
- ADVISE YOUR CLIENTS --- DESPITE EDDY CURRENT EXAMINATION & VISUAL INSPECTION, YOU CAN NOT GUARANTEE THAT (1) A CRACK IS NOT PRESENT (2) LEAKS COULD DEVELOPE BEFORE THE NEXT INSPECTION AND (3) WATER IS A POOR LEAK DETECTOR – CYLINDERS CAN PASS THE WATERJACKET TEST, LEAK GAS AND HAVE CRACKS
- BEST BET: HAVE YOUR ATTORNEY DEVELOPE A "HOLD HARMLESS AGREEMENT" AND PROPER WARNING TO YOUR CLIENTS. REQUIRE THE CYLINDER OWNER TO SIGN A WRITTEN ACKNOWLEDGEMENT AND UNDERSTAND THE RISKS

[Federal Register: July 26, 1994]

DEPARTMENT OF TRANSPORTATION
Research and Special Programs Administration
[Notice No. 94-7]

Safety Advisory; High Pressure Aluminum Seamless and Aluminum Composite Hoop-Wrapped Cylinders

AGENCY: Research and Special Programs Administration (RSPA), DOT.

ACTION: Safety advisory notice.

SUMMARY: RSPA is aware of ruptures involving two DOT-3AL cylinders made of aluminum alloy 6351-T6. Cylinder ruptures pose a risk of death, serious personal injury, and property damage. The purpose of this notice is to advise owners of certain cylinders made of aluminum alloy 6351-T6 to follow the precautionary measures outlined in this notice. RSPA also seeks information on ruptures involving other cylinders made of aluminum alloy 6351-T6.

FOR FURTHER INFORMATION CONTACT: Charles H. Hochman or Gopala K. Vinjamuri, telephone (202) 366-4545, Office of Hazardous Materials Technology, Research and Special Programs Administration, U.S. Department of Transportation, 400 Seventh Street SW, Washington, DC 20590-0001. Office hours are: 8:30 a.m. to 5 p.m., Monday through Friday, except holidays.

SUPPLEMENTARY INFORMATION: RSPA has been notified of the rupture of two DOT-3AL aluminum cylinders made of aluminum alloy 6351-T6. The first cylinder rupture occurred in Deer Park, Texas. This cylinder was manufactured in 1977 and was part of a self-contained breathing apparatus (SCBA) unit. It ruptured while being filled to its marked service pressure of 2216 pounds per square inch gauge (psig). The second cylinder rupture occurred in North Miami, Florida. This cylinder was manufactured in 1982 and was part of a self-contained underwater breathing apparatus (SCUBA) unit. It ruptured while being filled to its marked service pressure of 3000 psig. The person filling the SCUBA cylinder sustained serious injury. In both ruptures, a piece of the cylinder neck separated from the cylinder.

RSPA estimates that approximately seven million cylinders have been manufactured using aluminum alloy 6351-T6. RSPA presently does not know which cylinders among this population have the potential for similar failure. Cylinders made of aluminum alloy 6351-T6 are known to be susceptible to sustained load cracking (SLC) in the neck and shoulder area of the cylinder. Extensive research, testing and analysis have been performed on cylinders made of aluminum alloy 6351-T6 to determine any correlation

between SLC and the probability of rupture. Findings indicated that cylinders with a marked service pressure below 4000 psig failing due to SLC would leak and not rupture. Present data are inconclusive as to why the two cylinders noted here ruptured instead of leaked. RSPA is continuing to investigate the incidents.

Aluminum cylinders are widely used in industrial, medical, SCUBA and SCBA services. Aluminum alloy 6351-T6 has been used in the manufacture of the following DOT high pressure cylinders:

1. Cylinders (seamless aluminum) marked "DOT 3AL", including those marked with "DOT 3AL" above or near one of the following exemption or special permit numbers:

6498
7042
8107
8364
8422

2. Composite cylinders (aluminum-lined with hoop-wrapped, fiber-reinforced plastic) marked with one of the following exemption numbers:

7235
8023
8115

To RSPA's knowledge, no cylinders have been manufactured under the exemption or special permit numbers listed above, except DOT-E 7235, since 1984. Any cylinder marked with one of these exemption or special permit numbers most likely is made of aluminum alloy 6351-T6 (DOT-E 7235 cylinders are discussed more fully below). If in doubt, contact the cylinder manufacturer or distributor to identify the material of construction.

The primary domestic manufacturers of DOT-3AL cylinders currently in service are Luxfer USA; Walter Kidde Co.; Cliff Impact Division of Parker Hannifer Corporation; and Catalina Cylinders, a Division of Aluminum Precision Products Inc. Luxfer USA is the only manufacturer of DOT-E 7235 cylinders. Between 1987 and 1989, Luxfer USA discontinued using alloy 6351-T6 and changed to alloy 6061-T6 for DOT-3AL cylinders and DOT-E 7235 cylinder liners. Cylinders manufactured from alloy 6061-T6 are not believed to be susceptible to SLC; therefore, they are not subject to this advisory notice. According to Luxfer USA data, the following types of cylinders stamped as manufactured by Luxfer USA before the dates indicated below likely are made from alloy 6351-T6.

DOT	Service and type cylinder	Part no.	Date mfd.
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CO²

Spec. 3AL	1.2 and 1.5 lb.	C1.2, C1.5	1-89
Do	2.18 lb.	C2-18	11-88
Do	10 lb.	C10	8-88
Do	5 lb.	C5	6-88
Do	15 lb.	C15	11-87
Do	20 and 35 lb.	C20, C35	4-88
Do	50 lb.	C50	2-88

SCBA

Do	7, 8 and 13 cu. ft.	L7, L8, L13	9-87
Do	13.3 cu. ft.	L13-30	5-88
Do	15 cu. ft.	L15	1-89
Do	26 cu. ft.	L26	2-88
Do	45 cu. ft.	L45	11-87

SCUBA

Do	30 and 63 cu. ft.	S30, S63	5-88
Do	40 cu. ft.	S40	6-88
Do	50 and 92 cu. ft.	S50, S92	4-88
Do	72 and 100 cu. ft.	S72, S100	8-87
Do	80 cu. ft.	S80	1-88
Do	80.8 cu. ft.	S80.8	5-87

Medical O1

Do	C	M9	1-88
Do	D and E	MD, ME	12-87

Industrial

Do	22 and 150 cu. ft.	N22, N150	5-88
Do	33 cu. ft.	N33	11-88
Do	60 and 122 cu. ft.	N60, N122	12-87
Do	88 cu. ft.	N88	12-88
Do	Service Pressures 2016 and 3000 psig		8-89
E-7235	Service Pressure 4500 psig		See below.

All Walter Kidde DOT-3AL cylinders, of which production ceased in January 1990, are made of alloy 6351-T6. Cliff Impact DOT-3AL cylinders were made from alloy 6351-T6 before July 1990, at which time Cliff Impact changed to alloy 6061-T6. Catalina Cylinders did not produce any DOT-3AL cylinders from alloy 6351-T6; therefore, cylinders manufactured by Catalina are not subject to this notice.

Until determined otherwise, any DOT-3AL or DOT-E 7235 cylinder should be assumed to be made of alloy 6351-T6, if it was:

1. Manufactured by Luxfer USA before the applicable date listed in the chart above;
2. Manufactured by Cliff Impact before July 1990;
3. Manufactured by any other company in the United States, excluding Catalina, before February 1990, or
4. Manufactured outside the United States.

For aid in determining whether a cylinder is constructed with alloy 6351-T6, contact the cylinder manufacturer or distributor. RSPA will provide further information as it becomes available.

Any person who owns, uses, fills or retests an affected cylinder should take the following precautions:

1. Do not fill the cylinder to greater than the marked service pressure, except during a hydrostatic test.
2. Do not fill a cylinder that is beyond its required retest date.
3. Do not use a SCUBA or SCBA cylinder that is beyond its required retest date.
4. Whenever you remove the cylinder valve, visually inspect the interior of the cylinder neck and shoulder area for cracks.

Any evidence of a crack or crack-like defect may require further evaluation. Contact the cylinder retester, distributor or manufacturer for the procedure to be used in performing the visual inspection and for rejection criteria. For guidance on inspecting Luxfer USA cylinders, contact Luxfer USA Limited, Customer Service Department, PO Box 5300, Riverside CA 92517, telephone (909) 684-5110.

RSPA wishes to reiterate two previous advisories it has issued regarding DOT-E 7235 cylinders. On August 15, 1985, RSPA published an exemption-related notice [Notice 85-4, 50 FR 32944] to alert users that any cylinder marked DOT-E 7235, with a service pressure of 4500 psig and not equipped with a neckring was required to be removed from service by October 1, 1985. On March 24, 1993, RSPA published a safety advisory notice [Notice 93-8, 58 FR 15895] after being notified of the rupture of a cylinder authorized under DOT-E 7235 that had not been fitted with a neckring. Cylinders properly fitted with the required neckring are not susceptible to rupture. That notice stated in part:

Persons finding cylinders without the required neckring should immediately take the following precautions.

1. If a cylinder has been filled, its entire contents should be vented in order to relieve internal pressure.
2. The vented cylinders should be segregated from all other cylinders by being placed in a secured area and marked conspicuously with a tag bearing the notation "Do Not Use" or similar warning.
3. Under no circumstances should any of the cylinders in question be sold or otherwise transferred, filled, refilled or used for any purpose.

Once the above procedures have been taken, persons finding cylinders without neckrings should contact the company, or distributor from whom they were purchased, for their disposition.

Any person who is aware of the rupture of any DOT-3AL cylinder or any other cylinder manufactured from aluminum alloy 6351-T6, whether the incident was domestic or foreign, is requested to contact RSPA as soon as possible.

Issued in Washington, DC on July 20, 1994.

Alan I. Roberts, Associate Administrator for Hazardous Materials Safety.

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