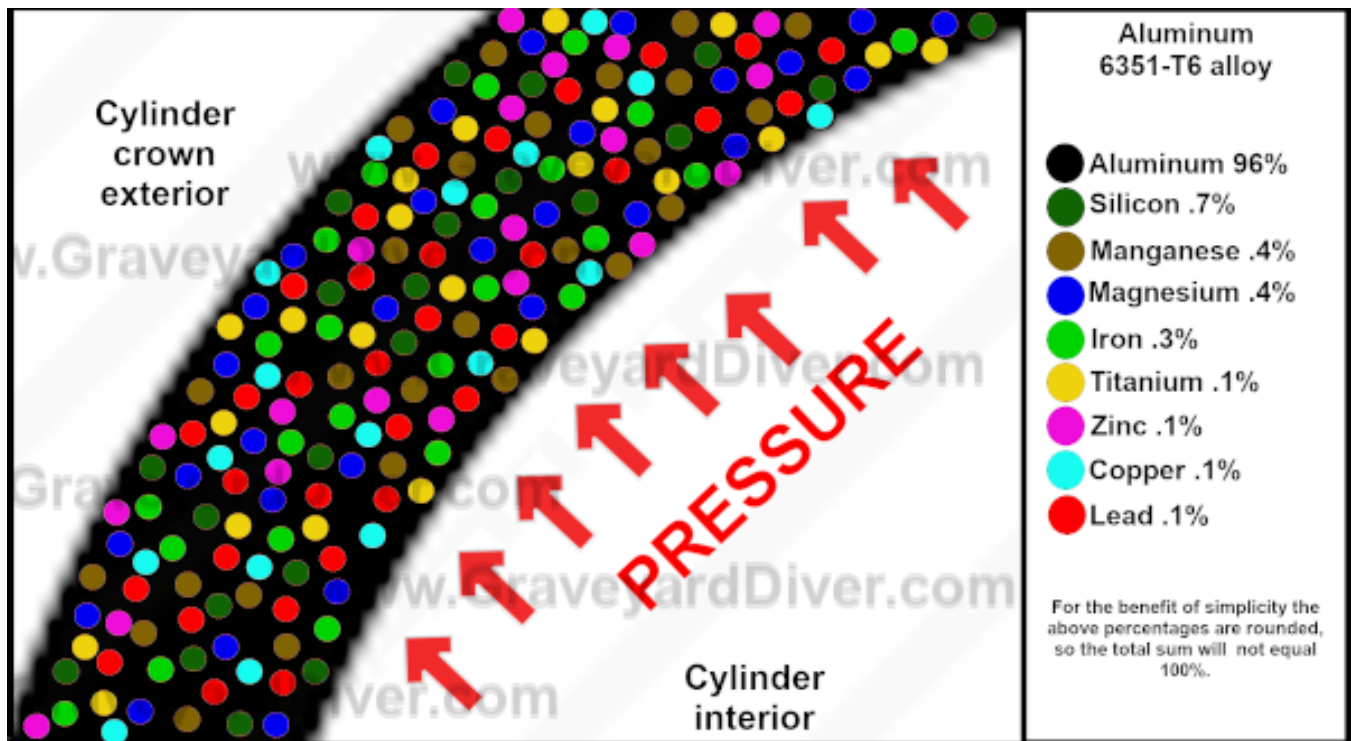


6351-T6 SCUBA Cylinder Alloy

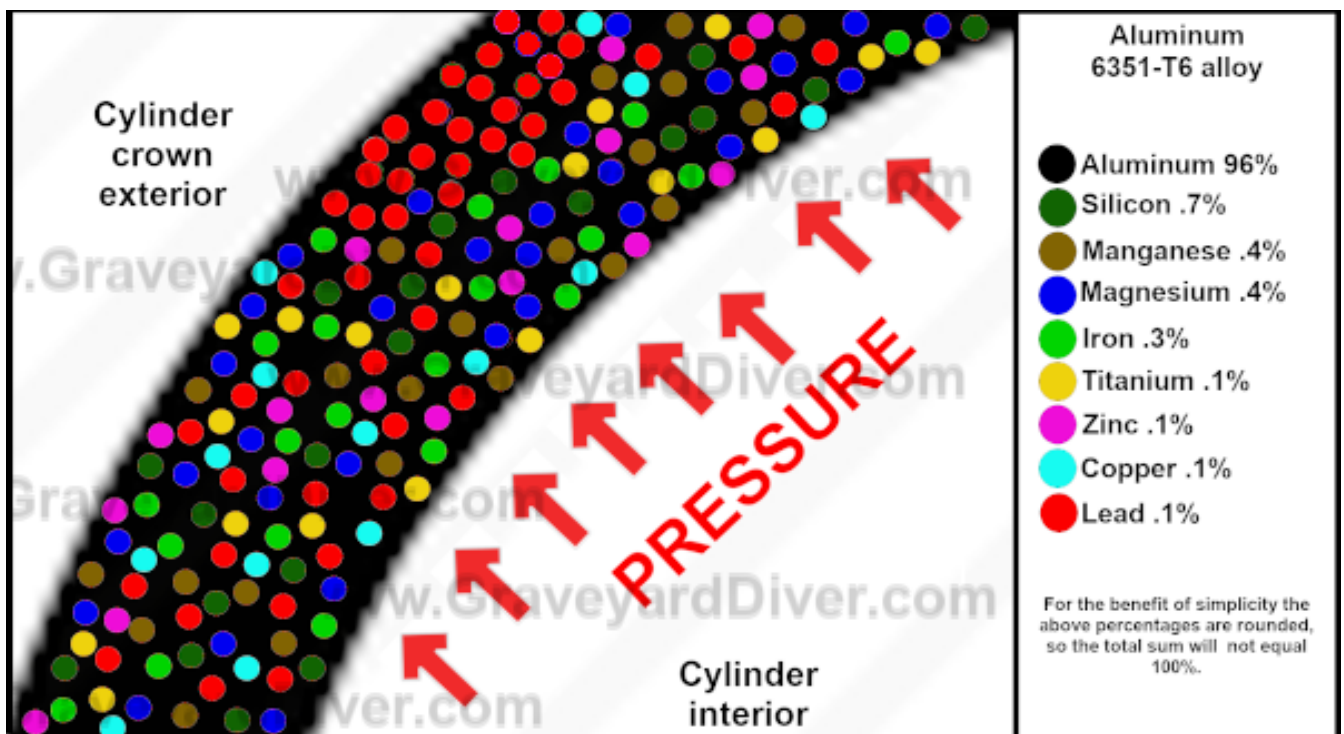
Sustained Load Cracking Explanation Diagram

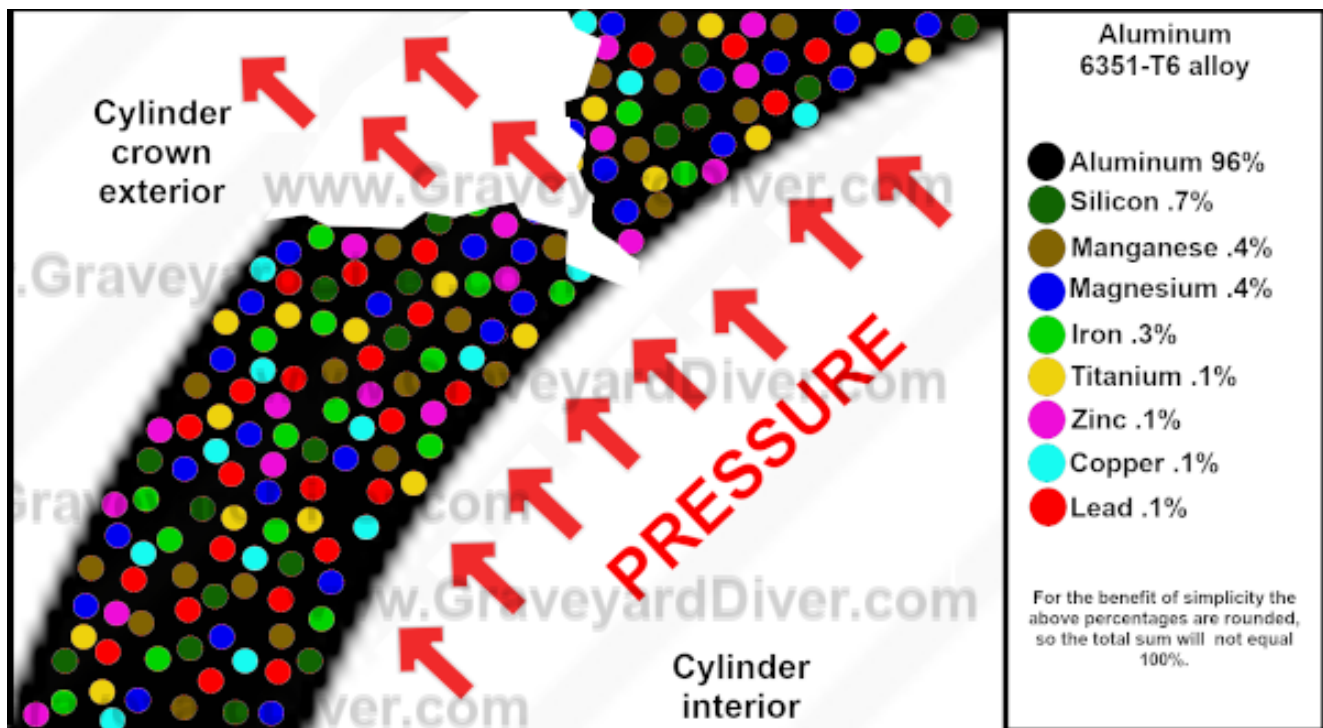
by Dr. Anthony Jones Boyette

Sustained load cracking is a phenomena of aluminum 6351-T6 Alloy that was used in SCUBA cylinder Manufacturing up until approximately 1988 by several SCUBA cylinder manufacturers. The phenomena can occur in 6351 alloy aluminum cylinders when high pressure cylinders are stored under pressure. The metallurgy basis for sustained load cracking in 6351-T6 alloy is attributed to lead used in the alloy. When high pressure cylinders are stored under pressure, the force of the pressure pushing against the cylinder walls of cylinders manufactured with 6451-T6 alloy causes the softer lead molecules to migrate away from the pressure (towards the exterior of the cylinder walls). When enough lead molecules occupy a common area, the cylinder wall is weakened in that area, and a stress crack in the wall of the cylinder forms. Thus, sustained load cracking is not a fast process like other types of stress cracking, but is a slow process that happens over time. Once the cylinder wall is weakened enough, catastrophic failure of the cylinder occurs. Death and/or serious injury often results. Sustained load cracking in 6351-T6 alloy cylinders can be detected with modern Eddy-current testing devices. Thus, the United States Department of Transportation has determined that 6351-T6 alloy SCUBA cylinders are safe to fill and use IF they pass the hydrostatic requalification, a visual inspection by a competent and formally trained visual inspector, and pass an eddy-current test. As of the date of this document, eddy-current testing is recommended (but not required) at the time of the annual scuba cylinder visual inspection. Eddy-current testing is required by DOT at the time of the 5-year hydrostatic requalification.



Softer lead molecules (red dots) migrate towards the exterior of the cylinder wall, causing that area of the cylinder wall to become weaker in that area.





When the cylinder wall weakens enough where the softer lead molecules have accumulated, a microscopic crack forms and catastrophic failure of the cylinder wall results. Pressure is instantly released from the cylinder in an “explosion” effect, blasting cylinder fragments away from the opening with the force of a U.S. military hand grenade. The cylinder, if effect, becomes a bomb.

PADI Master SCUBA Diver
PSI/PCI Cylinder Visual Inspector #30235
PSI/PCI Oxygen Technician #1922
PSI/PCI Valve Repair technician #2775