

White Paper

Self-Containing Breathing Apparatus (SCBA) Composite Cylinder Service Life Assessment

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Purpose of this paper is to articulate the second phase of the ongoing research efforts to assess the risk associated with continued usage of composite cylinders beyond the 15 year service life in SCBA applications.

Background

These SCBA cylinders are manufactured under Department of Transportation (DOT) special permits. The composite cylinders are made in accordance with DOT standard for carbon-fiber fully wrapped Composite cylinder with Reinforced Aluminum Liner, commonly call DOT – CFFC.

These cylinders have been used by emergency responders' for many years. Currently, the majority of SCBA composite cylinders are DOT- CFFC cylinders. The operating condition of DOT – CFFC cylinders in traditional firefighting applications varies based on frequency of their usage; however, when in use they are exposed to various environmental stresses that may be extreme and harsh. The Office of Hazardous Materials Safety is aware of and has monitored a research project conducted by the Department of the Navy on DOT - CFFC to cylinders to evaluate the performance of these composite cylinders which were close to end of service life and determine the possibility of extending the service life beyond 15 year for the Navy's shipboard firefighting application. Modal Acoustic Emission (MAE) testing has been used during this research project to assess various damages and to predict loss of composite cylinder strength during pressurization. The Department of the Navy possesses over 50,000 shipboard composite cylinders that are maintained under their own operating condition and maintenance program.

Testing and Analysis

A comprehensive design qualification testing was conducted to determine if these cylinders could be used safely beyond the current 15 year service life limit. Under the Navy research project, many composite cylinders were subjected to performance testing such as burst, pressure cycling, flaw tolerance and impact testing. Additionally, Non-Destructive Examination (NDE) has been applied during design qualification testing. The NDE methods were strain gaging and Modal Acoustic Emission (MAE) testing. These NDE were applied during the design qualification (physical) testing such as pressure cycling and burst testing to evaluate performance of each composite cylinder.

For second phase of this research project, over 100 composite cylinders (e.g. DOT – CFFC) will be collected from different Municipal Fire Stations across the USA and similar design qualification testing and NDE will apply on each cylinder.

Summary

Upon completion of this research project following objectives will be achieved:

- Whether or not DOT - CFFC cylinders in SCBA can safely be used beyond Its 15 year Service Life?
- Whether or not MAE testing combined with external visual inspection can be used in lieu of hydrostatic testing and internal visual inspection of DOT - CFFC cylinders during requalification?