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Title: Characterization and measurement of elastance with application to underwater breathing apparatus

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Keywords: underwater breathing apparatus  
elastance  
respiratory load

Issue Date: 1994

Citation: Undersea Hyperb Med. 1994 Mar; 21(1):53-65.

Abstract: The elastic loads inherent in underwater breathing apparatus (UBA) can affect diver performance. This work quantitatively examines elastance, its measurement by static tests, and its relationship to UBA. A rigid, fixed-volume container and a vertical water column with straight and parallel sides produce elastic loads that have application to closed-circuit UBA. We derived equations to describe the pressure-volume relationships of these elements from first principles and tested the equations experimentally for system pressure produced by a swept volume in a breathing machine. Our work demonstrates that simplified equations to describe elastance may not be sufficiently accurate for all situations. In addition, static measurements of elastance of a UBA or other element will not be reproducible unless all the volumes within the testing apparatus are accounted for; we provide experimental and mathematical techniques for doing so.

Description: Undersea and Hyperbaric Medical Society, Inc. (<http://www.uhms.org> )

URI: [PMID: 8180567](#)  
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