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# NASA TECH BRIEF



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## Fatigue Failure in Metal Bellows Due to Flow-Induced Vibrations

A study has been made in an effort to prevent fatigue failure due to flow-induced vibrations in metal bellows connected to ducts carrying liquid hydrogen. The study, based on an analysis of bellows structure, fluid dynamics, and the environment (that is, air or vacuum) surrounding the bellows, showed that the flexure lines are in general a function of the vibration coupling between the fluid and bellows structure and the nature of the external environment. Each design must be proved by flow testing over its operating range in both vacuum and atmospheric surroundings.

The results of this study are applicable to all metal flexure lines in which a flow-structural frequency coupling can occur and cause eventual fatigue failure of the metal. The information is important for lines carrying cryogenic liquids which condense air on their outer surfaces when tested in an air environment but whose actual service environment is a vacuum.

### Note:

Documentation is available from:  
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Springfield, Virginia 22151  
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### Patent status:

Inquiries about obtaining rights for the commercial use of this invention may be made to NASA, Code GP, Washington, D.C., 20546.

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