Fatigue Life Testing in Metal Expansion Joints

Fatigue life testing is a verification of the ability of a bellows to withstand a given number of flexing cycles.

The Expansion Joint is placed on a test machine and allowed to cycle continually until the bellows fails.

Fatigue life testing will render the Expansion Joint or at least the bellows unsuitable for installation in an operating system and therefor this test must be performed on a prototype Expansion Joint. A prototype Expansion Joint is defined as one having the same pressure and temperature rating as production models, identical diameter, height, pitch, and general shape of the convolution, the thickness and type of bellows materials, bellows reinforcement, method of manufacture, and maximum movement per convolution.

MACOGA performs fatigue testing at constant pressure or at varying pressure. This latter condition more closely approximates the service to which the Expansion Joint will be subjected.

It is acceptable to cycle test at room temperature any Expansion Joint which will be furnished for operating temperatures up to the active creep range. For Expansion Joints operating above this range, consideration should be given to testing at elevated temperatures.

With all other shape factors remaining constant, cycle life will generally increase with diameter; for prototype testing, it may be acceptable to cycle test the smallest size Expansion Joint being furnished for a given series for identical service condition.

Fatigue life expectancy

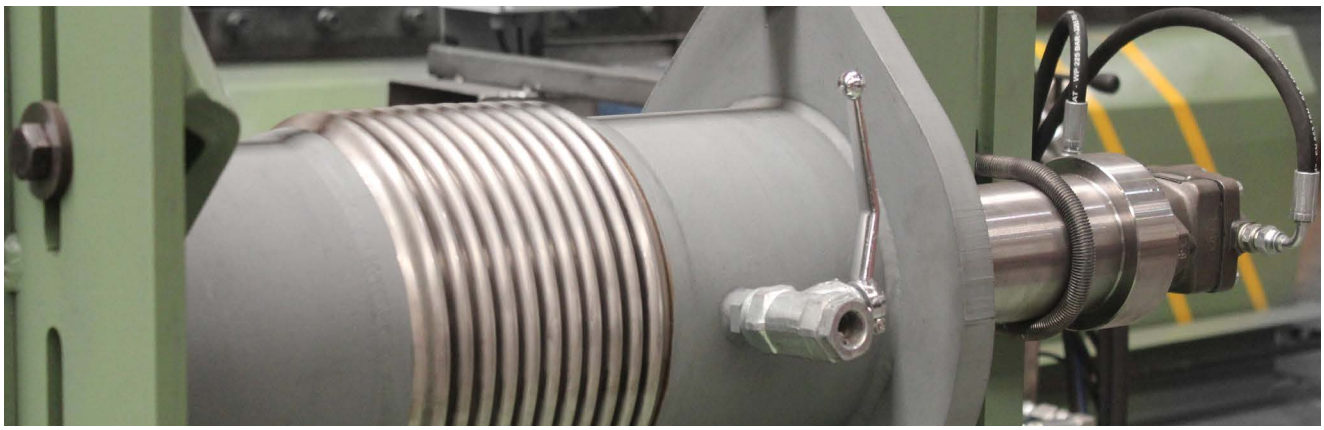
The fatigue life of a metal joint is affected by many factors such as temperature, pressure, movement, vibration and how the joint was initially designed. Typically, metal joints have a defined cycle or fatigue life that can be calculated.

Excessive cycle life requirements will not necessarily ensure desired results. An overly conservative estimate of cycles is not recommended because it will tend to increase the number of corrugations and will lead to a bellows more prone to squirm.

Fatigue life depends on the maximum stress range to which the bellows is submitted during each complete operational cycle. The stress range due to deflection generally affects the fatigue more than the stress range due to static or variable pressure.

Accordingly, the cycles to fatigue will be reduced if the deflection is increased and vice versa.

In addition to the shape of the corrugations, the fatigue life is affected by the type of material and the manufacturing process. The cold work hardening of austenitic steel for instance, induced during the forming process of the corrugations, generally improves the fatigue life.



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