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Is vibratory stress relief as effective as thermal stress relief?



Vibratory stress relief (VSR), despite being put to good use in many different industries world-wide for several decades, is still often regarded with distrust born out of ignorance of its capabilities and limitations. Its suitability as an alternative to thermal stress relief (TSR) depends on several factors, not least the desired end result.

VSR is most commonly used to achieve dimensional stability in welded and cast fabrications, and as such it has a proven successful track record. The precise amount of residual stress relaxation depends on the product, material and equipment used, and is difficult to predict. However, TSR is rarely 100% effective except on small, simple components, and is more often only capable of reducing peak residual stress by 70-80%. VSR is capable of giving equal stability to that achievable by TSR, but cannot promote any of the metallurgical benefits often associated with TSR. However, it can be used effectively on materials that are intolerant of thermal treatment, and is typically only a fraction of the cost of TSR. VSR should be used judiciously in fatigue sensitive applications, because of its potential to induce significant numbers of cycles of high strain.

Two variants of VSR are known to be effective: resonant VSR and modal sub-resonant VSR, the former being the more effective of the two. Of the two main types of VSR equipment, those with AC exciter motors are more capable than those with DC exciter motors. Like many processes, the success of VSR is dependent on both the equipment used and the skill of the operator.