

**A Tool For Evaluating Accelerated Life Test with Time-Varying
Stress Using A Log Location-Scale Distribution**

by

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ABSTRACT

Accelerated life tests (ALTs) are often used to make timely assessments of the life time distribution of materials and components. The goal of many ALTs is estimation of a quantile of a log-location failure time distribution. Much of the previous work on planning accelerated life tests has focused on deriving test-planning methods under a specific log-location distribution. This paper presents a new approach for computing approximate large-sample variances of maximum likelihood estimators of a quantile of general log-location distribution with censoring and time-varying stress. The approach is based on a cumulative exposure model. Using sample data from a published paper describing optimum ramp-stress test plans, we show that our approach and the one used in the previous work give the same variance-covariance matrix of the quantile estimator from the two different approaches. Then, as an application of this approach, we extend the previous work to a new optimum ramp-stress test plan obtained by simultaneously adjusting the ramp rate and the lower start level of stress. We find that the new optimum test plan can have a smaller variance than that of the optimum ramp-stress test plan previously obtained by adjusting only the ramp rate. We also compare optimum ramp-stress test plans with the more commonly used constant-stress accelerated life test plans. We also conduct simulations to provide insight and to check the adequacy of the large-sample approximate results obtained by the approach.