Accelerated Life Testing of the Metal Film Capacitors and Life Study of Single Phase Electronic Watthour Meters

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ABSTRACT

Accelerated life testing (ALT) was used to determine the life distribution of metal film capacitors with stress voltage as accelerating factor. At levels 460V, 690V and 920V, the 4:2:1 sample size allocation scheme was considered in the capacitors to the stress levels.

Distribution fitting results indicated that the Weibull distribution provided a better fit to the capacitor's life than the lognormal distribution based on the AIC values. As the stress voltage increased, the characteristic life parameter estimated decreased and the shape parameter estimates increased. Inverse power law (IPL) was used to relate the characteristic life parameters at different stress levels. At normal voltage condition 230 V, the computed characteristic life parameter of the metal film capacitors was 794,217.99 hours and shape parameter was 0.4498.

For meter life with capacitor related failures and meter life with competing risks Weibull distribution also provided better fit than the lognormal distribution based on the both AIC. For meters with capacitor related failures, the estimated characteristic life parameter was 309,323 hours and the shape parameter was 1.70857, while for meter with competing risk the estimated characteristic life parameter was 289,444 hours and the shape parameter was 1.62048. The results indicated that after 15 years, approximately 20% of the meters are expected to fail with capacitor related defects and 25% are expected to fail with a valid type of defect.

Keywords: Accelerated life testing, meter life study, distribution fitting and inverse power law.