



Standard Practice for Life and Reliability Testing Based on the Exponential Distribution¹

This standard is issued under the fixed designation E2696; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ϵ) indicates an editorial change since the last revision or reapproval.

1. Scope

1.1 This practice presents standard sampling procedures and tables for life and reliability testing in procurement, supply, and maintenance quality control operations as well as in research and development activities.

1.2 This practice describes general procedures and definitions of terms used in life test sampling and describes specific procedures and applications of the life test sampling plans for determining conformance to established reliability requirements.

1.3 This practice is an adaptation of the Quality Control and Reliability Handbook H-108, "Sampling Procedures and Tables for Life and Reliability Testing (Based on Exponential Distribution)," U.S. Government Printing Office, April 29, 1960.

1.4 A system of units is not specified in this practice.

1.5 *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.*

2. Referenced Documents

2.1 *ASTM Standards:*²

E456 Terminology Relating to Quality and Statistics

E2234 Practice for Sampling a Stream of Product by Attributes Indexed by AQL

E2555 Practice for Factors and Procedures for Applying the MIL-STD-105 Plans in Life and Reliability Inspection

3. Terminology

3.1 Definitions:

¹ This practice is under the jurisdiction of ASTM Committee E11 on Quality and Statistics and is the direct responsibility of Subcommittee E11.30 on Statistical Quality Control.

Current edition approved April 1, 2013. Published April 2013. Originally approved in 2009. Last previous edition approved in 2009 as E2696 – 09^{ε1}. DOI: 10.1520/E2696-09R13.

² For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

3.1.1 See Terminology E456 for a more extensive listing of terms in ASTM Committee E11 standards.

3.1.2 *consumer's risk*, β , n —probability that a lot having specified rejectable quality level will be accepted under a defined sampling plan. **E2555**

3.1.2.1 *Discussion*—In this practice, the consumer's risk is the probability of accepting lots with mean time to failure θ_1 .

3.1.2.2 *Discussion*—For the procedures of 9.7 and 9.8, the consumer's risk may also be defined as the probability of accepting lots with unacceptable proportion of lot failing before specified time, p_1 .

3.1.3 *life test*, n —process of placing one or more units of product under a specified set of test conditions and measuring the time until failure for each unit.

3.1.4 *mean time to failure*, θ , n —in life testing, the average length of life of items in a lot.

3.1.4.1 *Discussion*—Also known as mean life.

3.1.5 *number of failures*, n —number of failures that have occurred at the time the decision as to lot acceptability is reached.

3.1.5.1 *Discussion*—The expected number of failures required for decision is the average of the number of failures required for decision when life tests are conducted on a large number of samples drawn at random from the same exponential distribution.

3.1.6 *producer's risk*, α , n —probability that a lot having specified acceptable quality level will be rejected under a defined sampling plan.

3.1.6.1 *Discussion*—In this practice, the producer's risk is the probability of rejecting lots with mean time to failure θ_0 .

3.1.6.2 *Discussion*—For the procedures of 9.7 and 9.8, the producer's risk may also be defined as the probability of rejecting lots with acceptable proportion of lot failing before specified time, p_0 .

3.1.7 *sequential life test*, n —life test sampling plan whereby neither the number of failures nor the time required to reach a decision are fixed in advance but instead decisions depend on the accumulated results of the life test.

3.1.8 *unit of product*, n —that which is inspected to determine its classification as defective or nondefective or to count the number of defects. **E2234**