

**AES standard for
audio preservation and restoration —
Life expectancy of information
stored in recordable compact disc systems —
Method for estimating, based on
effects of temperature and relative humidity**

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Abstract

This standard specifies test methods for estimating the life expectancy of information stored in recordable compact disc systems. Only the effects of temperature and relative humidity on the media are considered.

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Foreword

[This foreword is not a part of AES *standard for audio preservation and restoration – Life expectancy of information stored in recordable compact disc systems – Method for estimating, based on effects of temperature and relative humidity*, AES38-2000.]

This standard was prepared by the SC-03-03 Working Group on Optical Systems and Media of the SC-03 Subcommittee on the Preservation and Restoration of Audio Recording as part of project AES-X53, Test methods for estimating the life expectancy of information stored in recordable compact disc systems based on effects of temperature and relative humidity. The standard was developed as part of project AES-X80, Liaison with ANSI/PIMA IT9-5.

The writing group was lead by William Murray.

William Murray, chair SC-03-03
1999-12-24

AES standard for audio preservation and restoration — Life expectancy of information stored in recordable compact disc systems — Method for estimating, based on effects of temperature and relative humidity

1 General

1.1 Scope

This standard specifies test methods for estimating the life expectancy of information stored in recordable compact disc systems. Only the effects of temperature and relative humidity on the media are considered.

The standardized life expectancy estimated using this model is defined for discs maintained at 25 °C and 50 % RH. Discs exposed to more severe conditions of temperature and humidity are expected to experience a shorter life. The test plan documented in this standard does not attempt to model degradation due to exposure to light, corrosive gases, contaminants, or mishandling, and variations in the playback subsystem.

1.2 Purpose

The purpose of this standard is to establish a methodology for estimating the life expectancy of information stored in recordable compact disc systems. This methodology provides a technically and statistically sound procedure for obtaining and evaluating accelerated test data. The methodology deals only with the effects of temperature and humidity on the retrievability of stored information. For this reason, this standard is primarily directed to those storage applications, for example, libraries and archives, in which exposure to other influences potentially detrimental to information life expectancy, such as chemical agents, intense light sources, and improper handling, is controlled and minimized.

NOTE It is possible that audio information can be played back using error correction from a disc that has exceeded its life expectancy according to this standard.

1.3 Summary

A sampling of eighty recorded discs is divided into five groups according to a specified plan. Each group of discs is exposed to one of five stresses, which are combinations of temperature and relative humidity. Periodically during the course of the exposure, each disc from each stress group has its block error rate measured. Data collected at each test interval for each individual disc are used to determine a lifetime for that disc. The disc lifetimes at each stress are fitted to a log-normal distribution to determine a mean lifetime for the stress. The resulting five mean lifetimes are regressed against temperature and relative humidity according to an Eyring acceleration model. This model is then used to estimate the distribution of lifetimes at a usage condition.

1.4 Assumptions

The validity of the procedure defined by this standard relies on three assumptions. It is assumed that the sample life distribution is appropriately modeled by the log-normal distribution. Also, it is assumed that the kinetics of the dominant failure mechanism are appropriately modeled by an Eyring acceleration model. Finally, it is assumed that the dominant failure mechanism acting during use is the same as that at the accelerated conditions. Hamada and

Stinson (see annex C) provide data indicating that these assumptions are applicable to CD-R systems.

2 Normative references

The following standards contain provisions, which, through reference in this text, constitute provisions of this document. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this document are encouraged to investigate the possibility of applying the most recent editions of the indicated standards.

ISO/IEC 10149 (1995-07), *Information technology — Data interchange on read-only 120 mm optical data disks (CD-ROM)*. Geneva, Switzerland: International Electrotechnical Commission.

IEC 60908 (1999-02), *Audio recording — Compact disc digital audio system*. Geneva, Switzerland: International Electrotechnical Commission.

3 Definitions

3.1

baseline

initial parameter measurement taken prior to any application of stress

3.2

stress

experimental variable to which the specimen is exposed for the duration of the test interval. In this standard, the stresses are confined to temperature and relative humidity

3.3

test cell

device that controls the stress to which the specimen is exposed

3.4

cumulative distribution function, $F(t)$

fraction of all units in the population that fail by time t , or the probability that a random unit drawn from the population fails by time t

3.5

log-normal cumulative distribution function

distribution defined by the following equation:

$$F(t) = (1/\sqrt{2\pi}) \int_0^1 (1/\sigma_t x) e^{((\ln(x)-\mu_t)/\sigma_t)^2} dx$$

where

t	is the time
σ_t	is the log standard deviation
μ_t	is the log mean
$\ln(x)$	= natural logarithm of x

NOTE When $t = e_{\mu}$ the log-normal cumulative distribution function evaluates to 0,5. In other words, the model predicts that at that time half of the samples have failed.