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Pneumatic fluid power — Assessment of component reliability by accelerated life testing — General guidelines and procedures

Transmissions pneumatiques — Évaluation de la fiabilité du composant par essai de durée de vie accélérée — Lignes directrices générales et modes opératoires

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ISO copyright office
Ch. de Blandonnet 8 • CP 401
CH-1214 Vernier, Geneva, Switzerland
Tel. +41 22 749 01 11
Fax +41 22 749 09 47
copyright@iso.org
www.iso.org

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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

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Introduction

This document is being released to document progress that the working group has developed for accelerated testing. It is a new method with which the working group members have very little experience, but has been used by institutional laboratories and taught at academic levels.

Some experimentation on air cylinders has been done at the Korean Institute of Machinery and Materials (KIMM), but the application to pneumatic components in general has not been evaluated.

This document is offered to members as a reference and model procedure, so that they can develop experience with its use in their own laboratories.

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Pneumatic fluid power — Assessment of component reliability by accelerated life testing — General guidelines and procedures

1 Scope

This document provides general procedures for assessing the reliability of pneumatic fluid power components using accelerated life testing and the method for reporting the results. These procedures apply to directional control valves, cylinders with piston rods, pressure regulators, and accessory devices – the same components covered by the ISO 19973 series of standards.

This document does not provide specific procedures for accelerated life testing of components. Instead, it explains the variability among methods and provides guidelines for developing an accelerated test method.

The methods specified in this document apply to the first failure, without repairs.

2 Normative references

There are no normative references in this document.

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 5598, ISO 19973-1 and the following apply. ISO and IEC maintain terminological databases for use in standardization at the following addresses:

— IEC Electropedia: available at http://www.electropedia.org/

— ISO Online browsing platform: available at http://www.iso.org/obp

3.1
B_x life
life of a component or assembly that has not been altered since its production, where its reliability is $(100-x)$ %; or the time at which $(100-x)$ % of the population has survived

Note 1 to entry: The cumulative failure fraction is x %. For example, if x = 10, the B_{10} life has a cumulative failure probability of 10 %.

3.2
acceleration factor
AF
ratio between the life at the normal use stress level and the life at the accelerated stress level

3.3
accelerated life test
ALT
process in which a component is forced to fail more quickly that it would have under normal use conditions and which provides information about the component's life characteristics

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3.4
destruct limit
stress level at which one or more of the component's operating characteristics is no longer within specification or the component is damaged and cannot recover when the stress is reduced

Note 1 to entry: Destruct limits are classified as a lower destruct limit and upper destruct limit.

3.5
failure mechanism
physical or chemical process that produces instantaneous or cumulative damage to the materials from which the component is made

3.6
failure mode
manifestation of the failure mechanism resulting from component failure or degradation

Note 1 to entry: The failure mode is the symptom of the aggressive activity of the failure mechanism in the component's areas of weakness, where stress exceeds strength.

3.7
failure rate
λ
frequency at which a failure occurs instantaneously at time t, given that no failure has occurred before t

3.8
highly accelerated life test
HALT
process in which components are subjected to accelerated environments to find weaknesses in the design and/or manufacturing process

Note 1 to entry: The primary accelerated environments include pressure and heat.

3.9
model for accelerated life testing
model that consists of a life distribution that represents the scatter in component life and a relationship between life and stress

Note 1 to entry: Life distribution examples: Weibull, Lognormal, Exponential, etc.

Note 2 to entry: Life and stress examples: Arrhenius, Eyring, Inverse Power Law, etc.

3.10
normal use conditions
test conditions at which a component is commonly used in the field, which can be less strenuous than rated conditions

3.11
termination cycle count
number of cycles on a test item when it reaches a threshold level for the first time

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