AS 60068.3.2—2003
IEC 60068-3-2:1976

Australian Standard™

Environmental testing

Part 3.2: Background information—Combined temperature/low air pressure tests

Standards Australia

This Australian Standard was prepared by Committee EL-026, Protective Enclosures and Environmental Testing for Electrical/Electronic Equipment. It was approved on behalf of the Council of Standards Australia on 28 February 2003 and published on 8 May 2003.

The following are represented on Committee EL-026:

Australian Chamber of Commerce and Industry

Australian Electrical and Electronic Manufacturers Association

Electrical Compliance Testing Authorities

Electrical Regulatory Authorities Council

Electricity Supply Association of Australia

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This Standard was issued in draft form for comment as DR 02488.

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Originated as AS 1099.3.2—1980.
Revised and redesignated as AS 60068.3.2—2003.

Published by Standards Australia International Ltd
GPO Box 5420, Sydney, NSW 2001, Australia

ISBN 0 7337 5150 4

PREFACE

This Standard was prepared by the Standards Australia Committee EL-026, Protective Enclosures and Environmental Testing for Electrical/Electronic Equipment to supersede AS 1099.3.2:1980, *Basic environmental testing procedures for electrotechnology*, Part 3: *Background information*, Section 2: *Combined temperature/low air pressure tests.*

The objective of this Standard is to provide the electrotechnology industry with a complete set of environmental test procedures published as a series under AS 60068 *Environmental testing*. This Standard is Part 3.2 of that series.

This Standard is identical with, and has been reproduced from, IEC 60068-3-2:1976, *Environmental testing – Part 3: Background information – Section Two – Combined temperature/low air pressure tests*.

As this Standard is reproduced from an International Standard, the following applies:

(a) Its number does not appear on each page of text and its identity is shown only on the cover and title page.

(b) In the source text 'this international standard' should read 'this Australian Standard'.

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In this Standard, the following print types are used:

– requirements proper: in arial type;

– *test specifications: in italic type;*

– explanatory matter: in smaller arial type.

Any international Standard referenced should be replaced by an equivalent Australian Standard when one is available. The availability of equivalent Australian Standards can be determined either from the Standards Australia catalogue or from the Standards Australia website (www.standards.com.au).

CONTENTS

NOTES

STANDARDS AUSTRALIA

Australian Standard

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1 General

For the combined temperature/low air pressure tests described in this publication, a range of air pressures covering ground or aircraft applications is considered. Air pressures below 10 mbar are outside the scope of these tests.

2 Reasons behind the design of the test

In the range of air densities considered, the mean free path of molecules is always a small fraction of a millimetre. The thermal conductivity and the absolute viscosity of air are then practically independent of the pressure. The air flux is in general of the viscous type or turbulent and therefore governed by the laws applicable to normal pressure.

The fundamental laws of heat transmission by free or forced air convection are, then, the same as for normal air pressures. As a consequence, all the considerations on convection given in IEC 60068-3-1 can also be applied – at least in general – to testing at reduced air pressures.

The reduction of the air density, ρ, however, considerably affects the value of the convection coefficient, α_c, which is a function of ρ^n with n = 0,5 – 0,7 (for both free and forced convection).

In a test on heat-dissipating specimens, forced air circulation can considerably reduce the specimen surface temperature compared with the value in "free air" conditions within the whole range of air pressures considered. This is illustrated in figure 1 which shows changes in the surface mean temperature of a homogeneous specimen with air velocity and pressure (constant power dissipation and air temperature).

As a consequence, the test method for a heat-dissipating specimen specifies "free air" conditions (with no forced air circulation) or an air velocity which is sufficiently low that the additional cooling effect is unimportant.

The α_c decrease, with decreasing air density, increases the importance of heat dissipation by radiation, especially at the lower pressures considered, although the heat transmission by convection cannot be disregarded.

The increased importance of radiation requires a careful control of the emissivity characteristics and of the temperature of the chamber walls, particularly at lower air pressures.

Due to the importance of thermal radiation at low air pressures, the thermal interaction between different heat-dissipating specimens in the same test chamber may be large and affect the reproducibility of the test.