

This is a preview of "ISO 15099:2003". [Click here to purchase the full version from the ANSI store.](#)

First edition
2003-11-15

Thermal performance of windows, doors and shading devices — Detailed calculations

*Performance thermique des fenêtres, portes et stores — Calculs
détaillés*



Reference number
ISO 15099:2003(E)

© ISO 2003

This is a preview of "ISO 15099:2003". [Click here to purchase the full version from the ANSI store.](#)

PDF disclaimer

This PDF file may contain embedded typefaces. In accordance with Adobe's licensing policy, this file may be printed or viewed but shall not be edited unless the typefaces which are embedded are licensed to and installed on the computer performing the editing. In downloading this file, parties accept therein the responsibility of not infringing Adobe's licensing policy. The ISO Central Secretariat accepts no liability in this area.

Adobe is a trademark of Adobe Systems Incorporated.

Details of the software products used to create this PDF file can be found in the General Info relative to the file; the PDF-creation parameters were optimized for printing. Every care has been taken to ensure that the file is suitable for use by ISO member bodies. In the unlikely event that a problem relating to it is found, please inform the Central Secretariat at the address given below.

© ISO 2003

All rights reserved. Unless otherwise specified, no part of this publication may be reproduced or utilized in any form or by any means, electronic or mechanical, including photocopying and microfilm, without permission in writing from either ISO at the address below or ISO's member body in the country of the requester.

ISO copyright office
Case postale 56 • CH-1211 Geneva 20
Tel. + 41 22 749 01 11
Fax + 41 22 749 09 47
E-mail copyright@iso.org
Web www.iso.org

Published in Switzerland

This is a preview of "ISO 15099:2003". [Click here to purchase the full version from the ANSI store.](#)

Contents

Foreword.....	iv
Introduction	v
1 Scope	1
2 Normative references	1
3 Symbols	2
3.1 General	2
3.2 Symbols and units	2
3.3 Subscripts	4
4 Determination of total window and door system properties	5
4.1 Thermal transmittance	5
4.2 Total solar energy transmittance	9
4.3 Visible transmittance	10
5 Vision area properties	10
5.1 Glazing layer optics	10
5.2 Glazing system optics	11
5.3 Vision area heat transfer	13
6 Frame effects	20
6.1 Area and lineal thermal transmittance	20
6.2 Governing equations for calculating thermal transmittance	20
6.3 Geometric representation and meshing	20
6.4 Solid materials	23
6.5 Effective conductivity — Glazing cavities	23
6.6 Effective conductivity — Unventilated frame cavities	23
6.7 Ventilated air cavities and grooves	30
7 Shading devices	31
7.1 Definitions	31
7.2 Optical properties	32
7.3 Slat type of shading	34
7.4 Ventilation	39
7.5 Total solar energy transmittance and thermal transmittance	50
8 Boundary conditions	50
8.1 General	50
8.2 Reference boundary conditions	50
8.3 Convective heat transfer	51
8.4 Longwave radiation heat transfer	55
8.5 Combined convective and radiative heat transfer	58
8.6 Prescribed density of heat flow rate	59
Annex A (informative) Solution technique for the multi-layer solar optical model	60
Annex B (normative) Thermophysical fill gas property values	62
Annex C (informative) Examples of calculated values for optical properties of slat type of shading devices	64
Bibliography	69

This is a preview of "ISO 15099:2003". [Click here to purchase the full version from the ANSI store.](#)

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.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of technical committees is to prepare International Standards. Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

ISO 15099 was prepared by Technical Committee ISO/TC 163, *Thermal performance and energy use in the built environment*.

This is a preview of "ISO 15099:2003". [Click here to purchase the full version from the ANSI store.](#)

Introduction

This International Standard describes a procedure for calculating indices of merit of many window and door products. The method provided in this International Standard allows the user to determine total window and door product indices of merit, *viz* thermal transmittance, total solar energy transmittance and visible light transmittance.

The procedures give the actual thermal performance of fenestration products for use in building energy analysis and for the evaluation of products in specific building applications. These procedures can also be used to produce data to compare products by using the standardized boundary conditions given either in this International Standard or taken from the appropriate International or National Standards (e.g., ISO 12567-1, ISO 10292, ISO 9050). This International Standard is also intended as a reference document for the description of models used in computer programs for detailed calculation of the thermal and optical transmission properties of window and door systems.

This International Standard gives detailed models for thermal and optical transmission in windows. These detailed models are necessary in many types of window to get agreement between calculations and tests.

Traditionally, windows have been characterized by separately calculating the “dark” or “night-time” thermal transmittance and the solar energy transmittance through the fenestration system. The thermal transmittance without the effect of solar radiation is calculated using the procedures given in ISO 10292 (for the vision portion) and the total solar energy transmittance, without taking into account the actual temperatures of the various panes, is obtained using ISO 9050. These calculations require the use of reference conditions that are not representative of actual conditions. In this International Standard the energy balance equations are set up for every glazing layer taking into account the solar absorption and actual temperatures. From these energy balance equations, the temperatures of the individual layers and gaps are determined. This is the only standard that takes into account these complex interactions. This more detailed analysis provides results that can then be expressed as thermal transmittance and τ_g -values and these values can differ from the results of simpler models.

Individual indices of merit obtained using fixed reference boundary conditions are useful for comparing products. However, the approach taken is the only way of calculating the energy performance of window systems for other environmental conditions including those conditions that may be encountered during hot box measurements.

Finally it must be emphasized that this International Standard is intended for use in computer programs. It was never intended as a “simplified calculation” procedure. Simplified methods are provided in other International Standards. It is essential that these programs produce consistent values and that they are based on a sound standard methodology. Although more complicated than the formulae used in the simplified standards, the formulae used in this International Standard are entirely appropriate for their intended use.