



**CSA  
Group**

**C22.2 No. 46-13**

# Electric air heaters



# Legal Notice for Standards

Canadian Standards Association (operating as “CSA Group”) develops standards through a consensus standards development process approved by the Standards Council of Canada. This process brings together volunteers representing varied viewpoints and interests to achieve consensus and develop a standard. Although CSA Group administers the process and establishes rules to promote fairness in achieving consensus, it does not independently test, evaluate, or verify the content of standards.

## Disclaimer and exclusion of liability

This document is provided without any representations, warranties, or conditions of any kind, express or implied, including, without limitation, implied warranties or conditions concerning this document’s fitness for a particular purpose or use, its merchantability, or its non-infringement of any third party’s intellectual property rights. CSA Group does not warrant the accuracy, completeness, or currency of any of the information published in this document. CSA Group makes no representations or warranties regarding this document’s compliance with any applicable statute, rule, or regulation.

IN NO EVENT SHALL CSA GROUP, ITS VOLUNTEERS, MEMBERS, SUBSIDIARIES, OR AFFILIATED COMPANIES, OR THEIR EMPLOYEES, DIRECTORS, OR OFFICERS, BE LIABLE FOR ANY DIRECT, INDIRECT, OR INCIDENTAL DAMAGES, INJURY, LOSS, COSTS, OR EXPENSES, HOWSOEVER CAUSED, INCLUDING BUT NOT LIMITED TO SPECIAL OR CONSEQUENTIAL DAMAGES, LOST REVENUE, BUSINESS INTERRUPTION, LOST OR DAMAGED DATA, OR ANY OTHER COMMERCIAL OR ECONOMIC LOSS, WHETHER BASED IN CONTRACT, TORT (INCLUDING NEGLIGENCE), OR ANY OTHER THEORY OF LIABILITY, ARISING OUT OF OR RESULTING FROM ACCESS TO OR POSSESSION OR USE OF THIS DOCUMENT, EVEN IF CSA GROUP HAS BEEN ADVISED OF THE POSSIBILITY OF SUCH DAMAGES, INJURY, LOSS, COSTS, OR EXPENSES.

In publishing and making this document available, CSA Group is not undertaking to render professional or other services for or on behalf of any person or entity or to perform any duty owed by any person or entity to another person or entity. The information in this document is directed to those who have the appropriate degree of experience to use and apply its contents, and CSA Group accepts no responsibility whatsoever arising in any way from any and all use of or reliance on the information contained in this document.

CSA Group is a private not-for-profit company that publishes voluntary standards and related documents. CSA Group has no power, nor does it undertake, to enforce compliance with the contents of the standards or other documents it publishes.

## Intellectual property rights and ownership

As between CSA Group and the users of this document (whether it be in printed or electronic form), CSA Group is the owner, or the authorized licensee, of all works contained herein that are protected by copyright, all trade-marks (except as otherwise noted to the contrary), and all inventions and trade secrets that may be contained in this document, whether or not such inventions and trade secrets are protected by patents and applications for patents. Without limitation, the unauthorized use, modification, copying, or disclosure of this document may violate laws that protect CSA Group’s and/or others’ intellectual property and may give rise to a right in CSA Group and/or others to seek legal redress for such use, modification, copying, or disclosure. To the extent permitted by licence or by law, CSA Group reserves all intellectual property rights in this document.

## Patent rights

Attention is drawn to the possibility that some of the elements of this standard may be the subject of patent rights. CSA Group shall not be held responsible for identifying any or all such patent rights. Users of this standard are expressly advised that determination of the validity of any such patent rights is entirely their own responsibility.

## Authorized use of this document

This document is being provided by CSA Group for informational and non-commercial use only. The user of this document is authorized to do only the following:

If this document is in electronic form:

- load this document onto a computer for the sole purpose of reviewing it;
- search and browse this document; and
- print this document if it is in PDF format.

Limited copies of this document in print or paper form may be distributed only to persons who are authorized by CSA Group to have such copies, and only if this Legal Notice appears on each such copy.

In addition, users may not and may not permit others to

- alter this document in any way or remove this Legal Notice from the attached standard;
- sell this document without authorization from CSA Group; or
- make an electronic copy of this document.

If you do not agree with any of the terms and conditions contained in this Legal Notice, you may not load or use this document or make any copies of the contents hereof, and if you do make such copies, you are required to destroy them immediately. Use of this document constitutes your acceptance of the terms and conditions of this Legal Notice.



# ***Standards Update Service***

*C22.2 No. 46-13*

*August 2013*

**Title:** *Electric air heaters*

**Pagination:** **65 pages** (viii preliminary and 57 text), each dated **August 2013**

To register for e-mail notification about any updates to this publication

- go on-line to **shop.csa.ca**
- click on **CSA Update Service**

The **List ID** that you will need to register for updates to this publication is **2421945**.

If you require assistance, please e-mail [techsupport@csagroup.org](mailto:techsupport@csagroup.org) or call 416-747-2233.

Visit CSA Group's policy on privacy at [csagroup.org/legal](http://csagroup.org/legal) to find out how we protect your personal information.



*C22.2 No. 46-13*  
***Electric air heaters***



*™A trade-mark of the Canadian Standards Association, operating as "CSA Group"*

*Published in August 2013 by CSA Group  
A not-for-profit private sector organization  
5060 Spectrum Way, Suite 100, Mississauga, Ontario, Canada L4W 5N6  
1-800-463-6727 • 416-747-4044*

***Visit our Online Store at [shop.csa.ca](http://shop.csa.ca)***



CSA Group prints its publications on Rolland Enviro100, which contains 100% recycled post-consumer fibre, is EcoLogo and Processed Chlorine Free certified, and was manufactured using biogas energy.

To purchase standards and related publications, visit our Online Store at [shop.csa.ca](http://shop.csa.ca) or call toll-free 1-800-463-6727 or 416-747-4044.

ISBN 978-1-55491-985-7

© 2013 CSA Group

All rights reserved. No part of this publication may be reproduced in any form whatsoever without the prior permission of the publisher.

# Contents

Technical Committee on Consumer and Commercial Products *vi*

Subcommittee on Electric Air-Heaters *vii*

Preface *viii*

## **1 Scope** 1

## **2 Reference publications** 2

## **3 Definitions** 3

## **4 General requirements** 5

## **5 Construction** 5

- 5.1 General 5
- 5.2 Enclosures for live parts 6
  - 5.2.1 General 6
  - 5.2.2 Assembly 6
  - 5.2.3 Construction 6
  - 5.2.4 Thickness 6
  - 5.2.5 Non-metallic enclosures, supports, and decorative parts 6
  - 5.2.6 Openings in enclosures (excluding guards) 7
  - 5.2.7 Reflectors 8
  - 5.2.8 Guards for heater elements 9
  - 5.2.9 Guards for moving parts 11
- 5.3 Protection against corrosion 11
- 5.4 Mechanical assembly 11
- 5.5 Receptacles 12
- 5.6 Supply connections 12
  - 5.6.1 Permanently connected heaters 12
  - 5.6.2 Portable heaters 13
  - 5.6.3 Terminal parts 14
  - 5.6.4 Strain relief 14
- 5.7 Electrical insulation 15
- 5.8 Thermal insulation 15
- 5.9 Current-carrying parts 16
- 5.10 Wiring 16
- 5.11 Heating and heater elements 16
- 5.12 Protection against overheating 17
- 5.13 Lampholders and lamps 20
- 5.14 Switches and controls 20
- 5.15 Overcurrent protection 21
- 5.16 Motors 21
- 5.17 Suppressors 22
- 5.18 Spacings 22
- 5.19 Grounding and bonding 22
- 5.20 Stability 23
- 5.21 Stand-off guards for cord-connected radiant heaters 23

**6 Marking 23**

- 6.1 Marking on the product 23
- 6.2 Instruction sheet, carton, tag 28

**7 Tests 28**

- 7.1 General 28
- 7.2 Rating 29
- 7.3 Test voltage 29
- 7.4 Temperature (normal) 30
- 7.5 Dielectric strength 33
- 7.6 Temperature (abnormal) 33
  - 7.6.1 General 33
  - 7.6.2 Test criteria 33
  - 7.6.3 Test materials for abnormal tests 34
  - 7.6.4 Abnormal test conditions 34
  - 7.6.5 Stationary and portable baseboard heaters and wall-mounted heaters (tests under abnormal conditions) 36
  - 7.6.6 Abnormal temperature tests for in-car heaters 37
  - 7.6.7 Abnormal input for heaters with PTC elements 37
  - 7.6.8 Cold ambient start-up for cord-connected heaters with PTC elements 37
  - 7.6.9 Starting 38
  - 7.6.10 Ruptured element test for forced-air cord-connected heaters with sheath-type heating elements 38
- 7.7 Extreme operating voltage (maximum) test 38
- 7.8 Strain relief 39
- 7.9 Overload and endurance — Manually operated switches 39
  - 7.9.1 General 39
  - 7.9.2 Overload (heater only) 39
  - 7.9.3 Overload (motor and heater) 39
  - 7.9.4 Endurance (heater only) 40
  - 7.9.5 Endurance (motor and heater) 40
- 7.10 Performance of fusible links 40
- 7.11 Physical abuse tests 40
- 7.12 Leakage current 41
- 7.13 Performance of thermally operated controls 42
  - 7.13.1 General 42
  - 7.13.2 Calibration 42
  - 7.13.3 Overload 43
  - 7.13.4 Endurance 43
  - 7.13.5 Conditioning and recalibration (temperature-limiting controls for stationary baseboard heaters) 43
- 7.14 Performance of heaters having PTC heater elements 43
  - 7.14.1 General 43
  - 7.14.2 Thermal cycling 44
  - 7.14.3 Humidity conditioning 44
  - 7.14.4 Low-temperature cycling 44
  - 7.14.5 Hot-cold conditioning 44
  - 7.14.6 Vibration 44
- 7.15 Hydrostatic test 45
  - 7.15.1 General 45
  - 7.15.2 Fusible plugs 45
- 7.16 Dropping melted particles test 45
- 7.17 Stability 45



**8 Requirements for cord-connected double-insulated electric air heaters 46**

- 8.1 Scope 46
  - 8.2 Definitions 46
  - 8.3 General requirements 46
  - 8.4 Construction 47
    - 8.4.1 General 47
    - 8.4.2 Openings and recesses 48
    - 8.4.3 Mechanical assembly 48
    - 8.4.4 Supply connections 48
    - 8.4.5 Spacings 49
  - 8.5 Marking 49
  - 8.6 Tests 49
    - 8.6.1 Dielectric strength 49
    - 8.6.2 Leakage current 49
    - 8.6.3 Abnormal operation 50
- 

**Tables**

- 1** — Minimum thickness for cast metal enclosures 50
  - 2** — Acceptable perforated metal panels 51
  - 3** — Openings in guards or enclosures for moving parts 51
  - 4** — Minimum spacings for bare live parts 52
  - 5** — Maximum temperatures 53
  - 6** — Number of cycles of operation for thermostat endurance test 54
  - 7** — Minimum spacings for double-insulated heaters 54
  - 8** — Minimum dielectric strength test voltages 55
- 

**Figures**

- 1** — Probe 56
- 2** — Leakage current measurement circuit 56
- 3** — Modifications for ruptured element sheath test 57
- 4** — Saw cut details for ruptured element sheath test 57

# ***Technical Committee on Consumer and Commercial Products***

<b>A. Milne</b>	21st Olympiad Sales, Burlington, Ontario <i>(Representing General Interests)</i>	<i>Chair</i>
<b>D. Mascarenhas</b>	Brampton, Ontario <i>(Representing General Interests)</i>	<i>Vice-Chair</i>
<b>L. Letea</b>	CSA Group, Mississauga, Ontario	<i>Project Manager</i>

## **Representing Regulatory Authorities**

<b>D.P. Badry</b>	Government of Yukon, Whitehorse, Yukon
<b>T. Olechna</b>	Electrical Safety Authority, Mississauga, Ontario
<b>D.G. Roy</b>	Health Canada, Ottawa, Ontario

## **Representing Manufacturers**

<b>J.E. Evans</b>	Evans Regulatory Certification Consulting, Jasper, Ontario
<b>W. Hansen</b>	Trane Ingersoll Rand, La Crosse, Wisconsin, USA
<b>S. Lawrence</b>	Cisco Systems Video Technology Canada, Inc., Scarborough, Ontario
<b>G. Lundy</b>	IBM Canada Limited, Markham, Ontario
<b>R. Martel</b>	Electro-Federation Canada, Toronto, Ontario
<b>S. Michaud</b>	Thomas & Betts Fabrication Inc./Thomas & Betts Manufacturing Inc., Dorval, Québec

## **Representing General Interests**

<b>R. Cleary</b>	The Home Depot Canada Inc., Toronto, Ontario
<b>R.L. Hicks</b>	Mississauga, Ontario
<b>M.K. Timmings</b>	Oakville, Ontario
<b>A.Z. Tsisserev</b>	Stantec Consulting Ltd., Vancouver, British Columbia

# ***Subcommittee on Electric Air-Heaters***

<b>M. Boudreault</b>	Régie du bâtiment du Québec, Québec, Québec	
<b>E. Brunette</b>	Convectair NMT Inc., Sainte-Thérèse, Québec	
<b>G. Cook</b>	Chromalox, Inc., Ogden, Utah, USA	
<b>G.C. Edwards</b>	Phillips & Temro Industries Inc., Eden Prairie, Minnesota, USA	
<b>D. Farchione</b>	Broan-NuTone LLC, Hartford, Wisconsin, USA	
<b>R. Hart</b>	I-Gard Corporation, Mississauga, Ontario	
<b>N. Lawrence</b>	London, Ontario	
<b>D. Lee</b>	CSA Group, Toronto, Ontario	
<b>A. Maldonado</b>	CCI Thermal Technologies Inc., Oakville, Ontario	
<b>S. Pouliot</b>	Stelpro Design Inc., Saint-Bruno, Québec	
<b>B. Rebel</b>	Association of Home Appliance Manufacturers Canada, Ottawa, Ontario	
<b>S. Richard</b>	Ouellet Canada Inc., Ville de L'Islet, Québec	
<b>D. Roy</b>	Ouellet Canada Inc., Ville de L'Islet, Québec	
<b>M. St-Aubin</b>	Global Commander Canada ULC, Shefford, Québec	
<b>D. TenEycke</b>	CCI Thermal Technologies Inc., Oakville, Ontario	
<b>D. Wilson</b>	Accredited Testing Services, Brandon, Manitoba	
<b>D.W. Wolbrink</b>	D W Wolbrink LLC, Slinger, Wisconsin, USA	
<b>M. Humphries</b>	CSA Group, Mississauga, Ontario	<i>Project Manager</i>

# Preface

This is the ninth edition of CSA C22.2 No. 46, *Electric air heaters*, one of a series of Standards issued by CSA Group under *Part II* of the *Canadian Electrical Code*. It supersedes previous editions published in 1988, 1981, 1980, 1971, 1966, 1959, 1942, and 1938.

This edition mainly serves to incorporate Updates 1 through 4 of the 1988 edition, modify the scope to clarify the products not covered by this Standard, and to update the reference publications.

For general information on the Standards of the *Canadian Electrical Code, Part II*, see the preface of CAN/CSA-C22.2 No. 0.

This Standard is considered suitable for use for conformity assessment within the stated scope of the Standard.

This Standard was prepared by the Subcommittee on Electric Air-Heaters, under the jurisdiction of the Technical Committee on Consumer and Commercial Products and the Strategic Steering Committee on Requirements for Electrical Safety, and has been formally approved by the Technical Committee.

**Interpretations:** The Strategic Steering Committee on Requirements for Electrical Safety has provided the following direction for the interpretation of standards under its jurisdiction: "The literal text shall be used in judging compliance of products with the safety requirements of this Standard. When the literal text cannot be applied to the product, such as for new materials or construction, and when a relevant committee interpretation has not already been published, CSA Group's procedures for interpretation shall be followed to determine the intended safety principle."

## Notes:

- (1) *Use of the singular does not exclude the plural (and vice versa) when the sense allows.*
- (2) *Although the intended primary application of this Standard is stated in its Scope, it is important to note that it remains the responsibility of the users of the Standard to judge its suitability for their particular purpose.*
- (3) *This Standard was developed by consensus, which is defined by CSA Policy governing standardization — Code of good practice for standardization as "substantial agreement. Consensus implies much more than a simple majority, but not necessarily unanimity". It is consistent with this definition that a member may be included in the Technical Committee list and yet not be in full agreement with all clauses of this Standard.*
- (4) *To submit a request for interpretation of this Standard, please send the following information to [inquiries@csagroup.org](mailto:inquiries@csagroup.org) and include "Request for interpretation" in the subject line:*
  - (a) *define the problem, making reference to the specific clause, and, where appropriate, include an illustrative sketch;*
  - (b) *provide an explanation of circumstances surrounding the actual field condition; and*
  - (c) *where possible, phrase the request in such a way that a specific "yes" or "no" answer will address the issue.*

*Committee interpretations are processed in accordance with the CSA Directives and guidelines governing standardization and are available on the Current Standards Activities page at [standardsactivities.csa.ca](http://standardsactivities.csa.ca).*
- (5) *This Standard is subject to review five years from the date of publication, and suggestions for its improvement will be referred to the appropriate committee. To submit a proposal for change, please send the following information to [inquiries@csagroup.org](mailto:inquiries@csagroup.org) and include "Proposal for change" in the subject line:*
  - (a) *Standard designation (number);*
  - (b) *relevant clause, table, and/or figure number;*
  - (c) *wording of the proposed change; and*
  - (d) *rationale for the change.*

# C22.2 No. 46-13

## ***Electric air heaters***

### **1 Scope**

#### **1.1**

This Standard applies to air heaters intended for use on nominal system voltages of 600 V or less and designed to be used in accordance with the *Canadian Electrical Code, Part I*.

#### **1.2**

This Standard applies to permanently connected and cord-connected air heaters for household, commercial, and industrial use in non-hazardous locations.

#### **1.3**

The term “air heater” includes the following types:

- (a) convection;
- (b) forced air;
- (c) radiation;
- (d) ceiling types, alone or in combination with lighting or ventilating components, or both;
- (e) liquid-filled radiator; and
- (f) combinations of (a), (b), or (c).

**Note:** For convenience, except where distinctions are necessary, portable and stationary air heaters are referred to throughout this Standard as “heaters”.

#### **1.4**

This Standard does not apply to

- (a) unit heaters involving only steam or hot-water heating with an electric air circulator;
- (b) electric duct heaters, as covered in CSA C22.2 No. 155;
- (c) central electric warm-air furnaces, as covered in CSA C22.2 No. 236; and
- (d) radiant space-heating panels
  - (i) installed below the subfloor;
  - (ii) mounted behind drywall or above plaster ceilings;
  - (iii) mounted above a suspended ceiling grid system;
  - (iv) forming all or part of a finished ceiling system; and
  - (v) dropped into a ceiling system in its final finished form.

Requirements for cord-connected double-insulated electric air heaters are specified in [Clause 8](#) of this Standard.

#### **1.5**

In this Standard, “shall” is used to express a requirement, i.e., a provision that the user is obliged to satisfy in order to comply with the standard; “should” is used to express a recommendation or that which is advised but not required; and “may” is used to express an option or that which is permissible within the limits of the standard.

Notes accompanying clauses do not include requirements or alternative requirements; the purpose of a note accompanying a clause is to separate from the text explanatory or informative material.

Notes to tables and figures are considered part of the table or figure and may be written as requirements.

Annexes are designated normative (mandatory) or informative (nonmandatory) to define their application.