



IEEE Std 844.3™-2019/CSA C22.2 No. 293.3:19

IEEE/CSA Standard for Impedance Heating of Pipelines and Equipment— General, Testing, Marking, and Documentation Requirements

IEEE Industry Applications Society

IEEE
3 Park Avenue
New York, NY 10016-5997
USA

CSA Group
178 Rexdale Boulevard
Toronto, Ontario, Canada
M9W 1R3

IEEE/CSA Standard for Impedance Heating of Pipelines and Equipment— General, Testing, Marking, and Documentation Requirements

This document was developed under the Partner Standards Development Organization cooperation agreement between IEEE and CSA Group and was submitted to a parallel approval vote by both organizations.

Sponsor

Petroleum and Chemical Industry Committee
of the
IEEE Industry Applications Society

Approved 8 February 2019

IEEE-SA Standards Board

Abstract: The general requirements, testing, markings, and documentation for impedance heating systems for pipes and equipment intended for use in general industrial applications are provided in this standard. This standard provides requirements when utilizing impedance heating systems in ordinary as well as hazardous areas having explosive atmospheres.

Keywords: condensation prevention, heating systems, IEEE 844.3, CSA C22.2 No. 293.3, process heating, freeze protection and temperature maintenance, re-melting solidified fluids, impedance heating, thermal insulation

The Institute of Electrical and Electronics Engineers, Inc.
3 Park Avenue, New York, NY 10016-5997, USA

Copyright © 2019 by The Institute of Electrical and
Electronics Engineers, Inc.
All rights reserved.
Published 28 April 2019.
Printed in the United States of America.

IEEE is a registered trademark in the U.S. Patent &
Trademark Office, owned by The Institute of Electrical
and Electronics Engineers, Incorporated.

PDF: ISBN 978-1-5044-5558-9 STD23555
Print: ISBN 978-1-5044-5559-6 STDPD23555

No part of this publication may be reproduced in any form,
in an electronic retrieval system or otherwise, without the
prior written permission of the publisher.

CSA Group
A not-for-profit private sector organization

178 Rexdale Boulevard
Toronto, Ontario, Canada
M9W 1R3

1-800-463-6727 • 416-747-4044

Visit the CSA Group Online Store at
<https://store.csagroup.org/>

ISBN 978-1-4883-1502-2
© 2019 Canadian Standards Association

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

Important Notices and Disclaimers Concerning IEEE Standards Documents

IEEE documents are made available for use subject to important notices and legal disclaimers. These notices and disclaimers, or a reference to this page, appear in all standards and may be found under the heading “Important Notice” or “Important Notices and Disclaimers Concerning IEEE Standards Documents.”

Notice and Disclaimer of Liability Concerning the Use of IEEE Standards Documents

IEEE Standards documents (standards, recommended practices, and guides), both full-use and trial-use, are developed within IEEE Societies and the Standards Coordinating Committees of the IEEE Standards Association (“IEEE-SA”) Standards Board. IEEE (“the Institute”) develops its standards through a consensus development process, approved by the American National Standards Institute (“ANSI”), which brings together volunteers representing varied viewpoints and interests to achieve the final product. Volunteers are not necessarily members of the Institute and participate without compensation from IEEE. While IEEE administers the process and establishes rules to promote fairness in the consensus development process, IEEE does not independently evaluate, test, or verify the accuracy of any of the information or the soundness of any judgments contained in its standards.

IEEE does not warrant or represent the accuracy or content of the material contained in its standards, and expressly disclaims all warranties (express, implied and statutory) not included in this or any other document relating to the standard, including, but not limited to, the warranties of: merchantability; fitness for a particular purpose; non-infringement; and quality, accuracy, correctness, currency, or completeness of material. In addition, IEEE disclaims any and all conditions relating to: results; and workmanlike effort. IEEE standards documents are supplied “AS IS” and “WITH ALL FAULTS.”

Use of an IEEE standard is wholly voluntary. The existence of an IEEE standard does not imply that there are no other ways to produce, test, measure, purchase, make, or provide other goods and services related to the scope of the IEEE standard. Furthermore, the viewpoint expressed at the time a standard is approved and issued is subject to change brought about through developments in the state of the art and comments received from users of the standard.

In publishing and making its standards available, IEEE is not suggesting or rendering professional or other services for, or on behalf of, any person or entity nor is IEEE undertaking to perform any duty owed by any other person or entity to another. Any person utilizing any IEEE Standards document, should rely upon his or her own independent judgment in the exercise of reasonable care in any given circumstances or, as appropriate, seek the advice of a competent professional in determining the appropriateness of a given IEEE standard.

IN NO EVENT SHALL IEEE BE LIABLE FOR ANY DIRECT, INDIRECT, INCIDENTAL, SPECIAL, EXEMPLARY, OR CONSEQUENTIAL DAMAGES (INCLUDING, BUT NOT LIMITED TO: PROCUREMENT OF SUBSTITUTE GOODS OR SERVICES; LOSS OF USE, DATA, OR PROFITS; OR BUSINESS INTERRUPTION) HOWEVER CAUSED AND ON ANY THEORY OF LIABILITY, WHETHER IN CONTRACT, STRICT LIABILITY, OR TORT (INCLUDING NEGLIGENCE OR OTHERWISE) ARISING IN ANY WAY OUT OF THE PUBLICATION, USE OF, OR RELIANCE UPON ANY STANDARD, EVEN IF ADVISED OF THE POSSIBILITY OF SUCH DAMAGE AND REGARDLESS OF WHETHER SUCH DAMAGE WAS FORESEEABLE.

Translations

The IEEE consensus development process involves the review of documents in English only. In the event that an IEEE standard is translated, only the English version published by IEEE should be considered the approved IEEE standard.

Official statements

A statement, written or oral, that is not processed in accordance with the IEEE-SA Standards Board Operations Manual shall not be considered or inferred to be the official position of IEEE or any of its committees and shall not be considered to be, or be relied upon as, a formal position of IEEE. At lectures, symposia, seminars, or educational courses, an individual presenting information on IEEE standards shall make it clear that his or her views should be considered the personal views of that individual rather than the formal position of IEEE.

Comments on standards

Comments for revision of IEEE Standards documents are welcome from any interested party, regardless of membership affiliation with IEEE. However, IEEE does not provide consulting information or advice pertaining to IEEE Standards documents. Suggestions for changes in documents should be in the form of a proposed change of text, together with appropriate supporting comments. Since IEEE standards represent a consensus of concerned interests, it is important that any responses to comments and questions also receive the concurrence of a balance of interests. For this reason, IEEE and the members of its societies and Standards Coordinating Committees are not able to provide an instant response to comments or questions except in those cases where the matter has previously been addressed. For the same reason, IEEE does not respond to interpretation requests. Any person who would like to participate in revisions to an IEEE standard is welcome to join the relevant IEEE working group.

Comments on standards should be submitted to the following address:

Secretary, IEEE-SA Standards Board
445 Hoes Lane
Piscataway, NJ 08854 USA

Laws and regulations

Users of IEEE Standards documents should consult all applicable laws and regulations. Compliance with the provisions of any IEEE Standards document does not imply compliance to any applicable regulatory requirements. Implementers of the standard are responsible for observing or referring to the applicable regulatory requirements. IEEE does not, by the publication of its standards, intend to urge action that is not in compliance with applicable laws, and these documents may not be construed as doing so.

Copyrights

IEEE draft and approved standards are copyrighted by IEEE under U.S. and international copyright laws. They are made available by IEEE and are adopted for a wide variety of both public and private uses. These include both use, by reference, in laws and regulations, and use in private self-regulation, standardization, and the promotion of engineering practices and methods. By making these documents available for use and adoption by public authorities and private users, IEEE does not waive any rights in copyright to the documents.

Photocopies

Subject to payment of the appropriate fee, IEEE will grant users a limited, non-exclusive license to photocopy portions of any individual standard for company or organizational internal use or individual, non-commercial use only. To arrange for payment of licensing fees, please contact Copyright Clearance Center, Customer Service, 222 Rosewood Drive, Danvers, MA 01923 USA; +1 978 750 8400. Permission to photocopy portions of any individual standard for educational classroom use can also be obtained through the Copyright Clearance Center.

Updating of IEEE Standards documents

Users of IEEE Standards documents should be aware that these documents may be superseded at any time by the issuance of new editions or may be amended from time to time through the issuance of amendments, corrigenda, or errata. An official IEEE document at any point in time consists of the current edition of the document together with any amendments, corrigenda, or errata then in effect.

Every IEEE standard is subjected to review at least every ten years. When a document is more than ten years old and has not undergone a revision process, it is reasonable to conclude that its contents, although still of some value, do not wholly reflect the present state of the art. Users are cautioned to check to determine that they have the latest edition of any IEEE standard.

In order to determine whether a given document is the current edition and whether it has been amended through the issuance of amendments, corrigenda, or errata, visit the IEEE-SA Website at <http://ieeexplore.ieee.org/xpl/standards.jsp> or contact IEEE at the address listed previously. For more information about the IEEE-SA or IEEE's standards development process, visit the IEEE-SA Website at <http://standards.ieee.org>.

Errata

Errata, if any, for all IEEE standards can be accessed on the IEEE-SA Website at the following URL: <http://standards.ieee.org/findstds/errata/index.html>. Users are encouraged to check this URL for errata periodically.

Patents

Attention is called to the possibility that implementation of this standard may require use of subject matter covered by patent rights. By publication of this standard, no position is taken by the IEEE with respect to the existence or validity of any patent rights in connection therewith. If a patent holder or patent applicant has filed a statement of assurance via an Accepted Letter of Assurance, then the statement is listed on the IEEE-SA Website at <http://standards.ieee.org/about/sasb/patcom/patents.html>. Letters of Assurance may indicate whether the Submitter is willing or unwilling to grant licenses under patent rights without compensation or under reasonable rates, with reasonable terms and conditions that are demonstrably free of any unfair discrimination to applicants desiring to obtain such licenses.

Essential Patent Claims may exist for which a Letter of Assurance has not been received. The IEEE is not responsible for identifying Essential Patent Claims for which a license may be required, for conducting inquiries into the legal validity or scope of Patents Claims, or determining whether any licensing terms or conditions provided in connection with submission of a Letter of Assurance, if any, or in any licensing agreements are reasonable or non-discriminatory. Users of this standard are expressly advised that determination of the validity of any patent rights, and the risk of infringement of such rights, is entirely their own responsibility. Further information may be obtained from the IEEE Standards Association.

CSA Group 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 statutory 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 owners’ rights

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

IEEE Std 844.3™-2019/CSA C22.2 No. 293.3:19

April 2019

Title: Standard for Impedance Heating of Pipelines and Equipment—General Testing, Marking, and Documentation Requirements

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

- go to <https://store.csagroup.org>
- click on **CSA Update Service**

The List ID that you will need to register for updates to this publication is **2426269**.

If you require assistance, please e-mail techsupport@csagroup.org or call 416-747-2233.

Visit CSA Group's policy on privacy at www.csagroup.org/legal to find out how we protect your personal information.

IEEE Participants

At the time this standard was completed, the Electrical Impedance, Induction, and Skin Effect Heating of Pipelines and Vessels (IAS/PCI/844WG) Working Group had the following voting membership:

Roy Barth, Chair
Franco Chakkalakal, Vice Chair
Derek Polk, Secretary

Mike Day
Tim Driscoll
Neal Fenster
Todd Hamden

Ben C. Johnson
Andrew Lozinski
David Parman
Rudolf Pommé

Gustavo Saldarriaga
Jerold Sauter
John Turner
Joseph Young

The following members of the individual balloting committee voted on this standard. Balloters may have voted for approval, disapproval, or abstention.

Roy Barth
Paul Becker
Demetrio Bucaneg, Jr.
Paul Cardinal
Franco Chakkalakal
David E. DeLuca
Donald Dunn
Robert Durham
Neal Fenster
Pamela Gold
J. Travis Griffith

Randall Groves
Werner Hoelzl
Richard Hulett
Noriyuki Ikeuchi
Ben C. Johnson
Jim Kulchisky
Benjamin Lanz
Arturo Maldonado
William McBride
Paul Myers
Arthur Neubauer
David Parman

Derek Polk
Nicholas Rafferty
Gustavo Saldarriaga
Jerold Sauter
Robert Seitz
Kris Sommerstad
Larry Stehling
John Turner
Kenneth White
Jian Yu
Charles Yung

When the IEEE-SA Standards Board approved this standard on 8 February 2019, it had the following membership:

Gary Hoffman, Chair
Vacant Position, Vice Chair
Jean-Philippe Faure, Past Chair
Konstantinos Karachalios, Secretary

Masayuki Ariyoshi
Ted Burse
Stephen D. Dukes
J. Travis Griffith
Guido Hietz
Christel Huner
Thomas Koshy
Joseph Koepfinger*

Thomas Koshy
John D. Kulick
David J. Law
Joseph Levy
Howard Li
Xiaohui Liu
Kevin Lu
Daleep Mohla
Andrew Myles

Annette D. Reilly
Dorothy Stanley
Sha Wei
Phil Wennblom
Philip Winston
Howard Wolfman
Feng Wu
Jingyi Zhou

*Member Emeritus

CSA Group Participants

At the time this IEEE/CSA Group standard was completed, the CSA Technical Committee on Wiring Products had the following membership:

P. Desilets	Leviton Manufacturing of Canada Limited, Pointe-Claire, Québec, Canada <i>Category: Producer Interest</i>	<i>Chair</i>
T. Simmons	British Columbia Institute of Technology, Burnaby, British Columbia, Canada <i>Category: General Interest</i>	<i>Vice Chair</i>
W.J. Burr	Burr and Associates, Campbell River, British Columbia, Canada <i>Category: User Interest</i>	
C. Davis	Electro Cables Incorporated, Trenton, Ontario, Canada <i>Category: Producer Interest</i>	
S.W. Douglas	International Association of Electrical Inspectors (IAEI), Toronto, Ontario, Canada <i>Category: General Interest</i>	
D. Drysdale	Nexans Canada Inc., Fergus, Ontario, Canada <i>Category: Producer Interest</i>	
R.W. Horner	Atkore International (Allied Tube & Conduit Corporation), Harvey, Illinois, USA <i>Category: Producer Interest</i>	
J. Imlah	Imlah Electrical Consulting, Aloha, Oregon, USA <i>Category: User Interest</i>	
R.J. Kelly	Nunavut Department of Community and Government Services, Iqaluit, Nunavut, Canada <i>Category: Regulatory Authority</i>	
S. Mallikarachchi	City of Winnipeg Planning, Winnipeg, Manitoba, Canada <i>Category: Regulatory Authority</i>	
S. Mercier	Région de l'Est du Québec, Montreal, Québec, Canada <i>Category: Regulatory Authority</i>	
T. Olechna	Electrical Safety Authority, Mississauga, Ontario, Canada <i>Category: Regulatory Authority</i>	
K.L. Rodel	Hubbell Canada LP, Pickering, Ontario, Canada <i>Category: Producer Interest</i>	
A.Z. Tisserand	AES Engineering, Vancouver, British Columbia, Canada <i>Category: General Interest</i>	
Turner	Swansea Consulting, Toronto, Ontario, Canada <i>Category: User Interest</i>	
L. Letea	CSA Group, Toronto, Ontario, Canada	<i>Project Manager</i>

At the time this IEEE/CSA Group standard was completed, the CSA Integrated Committee on Trace Heating had the following membership:

J. Turner	Swansea Consulting, Toronto, Ontario, Canada	<i>Chair</i>
E.D. Stephens	EGS EasyHeat Ltd., Elmira, Ontario, Canada	<i>Vice Chair</i>
D. Allcorn	Watts Radiant, Inc., Springfield, Missouri, USA	
S. Baril	Serge Baril & Associates Inc., Laval, Québec, Canada	
R. Barth	Thermon, Inc., San Marcos, Texas, USA	
M. Beaulieu	Flextherm Inc., Longueuil, Québec, Canada	
D.G. Brooks	Calgary, Alberta, Canada	
J. Bylinski	Stelpro Design Inc., St-Bruno-de-Montarville, Québec, Canada	
T. De Francesco	Aeromation Inc., Vancouver, British Columbia, Canada	
A.J. Donlan	EGS EasyHeat Ltd., Elmira, Ontario, Canada	
T.S. Driscoll	OBIEC Consulting Ltd., Calgary, Alberta, Canada	
K. Foley	EJD Solutions and Quality Inc., Calgary, Alberta, Canada	
G. Gagnon	Schluter Systems (Canada) Inc., Ste-Anne-de-Bellevue, Québec, Canada	
T. Hamden	CSA Group, Toronto, Ontario, Canada	
D. Hawkes	CSA Group, Toronto, Ontario, Canada	
M. Irgens	Electro Plastics, Inc., St. Louis, Missouri, USA	
B.C. Johnson	Thermon, Inc., New Braunfels, Texas, USA	
R. Johnson	ElectroTex Element Corp., Mississauga, Ontario, Canada	
K. Kilbride	Therma-Ray Incorporated, Fredericton, New Brunswick, Canada	

S.R. Kuscsik	Underwriters Laboratories Inc., Northbrook, Illinois, USA	
T. Lassila	Underwriters Laboratories Inc., Camas, Washington, USA	
G. Lemieux	Britech Corp., Toronto, Ontario, Canada	
J. Lim	nVent Thermal Canada Ltd., Edmonton, Alberta, Canada	
R. Loiselle	Suncor Energy Inc., Calgary, Alberta, Canada	
M. Marengère	Drexma Industries Inc., St-Basile-le-Grand, Québec, Canada	
D. Moro	Stelpro Design Inc., St-Bruno-de-Montarville, Québec, Canada	
C. Myers	Chromalox, La Vergne, Tennessee, USA	
B. Spira	Drexan Energy Systems, Inc., Kelowna, British Columbia, Canada	
J. Willner	Bolton, Ontario, Canada	
L.J. Young	Thermon Canada Inc., London, Ontario, Canada	
L. Tiracchia	CSA Group, Toronto, Ontario, Canada	<i>Project Manager</i>

IEEE Introduction

This introduction is not part of IEEE Std 844.3-2019/CSA C22.2 293.3:19, IEEE/CSA Standard for Impedance Heating of Pipelines and Equipment—General, Testing, Marking, and Documentation Requirements.

Impedance heating systems have been used for a number of years in the industry. Impedance heating of pipes and equipment in petrochemical as well as other industries is a portion of total heating requirements.

This standard should be read in conjunction with IEEE Std 844.4™/CSA C293.4, IEEE/CSA Standard for Impedance Heating of Pipelines and Equipment—Application Guide for Design, Installation, Testing, Commissioning, and Maintenance.

Since impedance heating systems are interrelated with electric power, control, and alarm systems, other standards (some of which are listed in [Clause 2](#)) should be referred to when using this standard. This standard is not intended to supersede any current standards or recommended practices, and sound engineering judgment should always be used when applying this or any other standard.

CSA Preface

This is the first edition of IEEE Std 844.3™/CSA C22.2 No. 293.3, IEEE/CSA Standard for Impedance Heating of Pipelines and Equipment—General, Testing, Marking, and Documentation Requirements, which is a harmonized Standard jointly developed by IEEE and CSA Group. It is one in a series of Standards issued by CSA Group under Part II of the *Canadian Electrical Code*.

Impedance heating systems have been used for a number of years in the industry. Impedance heating of pipes and equipment in petrochemical as well as other industries is a growing portion of total heating requirements.

This standard should be used in conjunction with IEEE Std 844.4™/CSA C293.4, IEEE/CSA Standard for Impedance Heating of Pipelines and Equipment—Application Guide for Design, Installation, Testing, Commissioning, and Maintenance.

Since impedance heating systems are interrelated with electric power, control, and alarm systems, other standards (some of which are listed in Clause 2) should be referred to when using this standard.

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

This standard was reviewed for use in Canada by the CSA Integrated Committee on Trace Heating, under the jurisdiction of the CSA Technical Committee on Wiring Products and the CSA Strategic Steering Committee on Requirements for Electrical Safety, and has been formally approved by the CSA 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 CSA 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 publication 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 publication.
- 4) To submit a request for interpretation of this standard, please send the following information to **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**.
- 5) This standard is subject to review within five years from the date of publication. 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** and include “Proposal for change” in the subject line:
 - a) Designation;
 - b) Relevant clause, table, and/or figure number;
 - c) Wording of the proposed change; and
 - d) Rationale for the change.

Contents

1. Overview	16
1.1 General	16
1.2 Scope	16
1.3 Purpose	17
1.4 Typical applications.....	17
2. Normative references.....	18
3. Definitions	19
4. General requirements.....	22
4.1 Principle of operation	22
4.2 System	23
4.3 Electrical circuit protection.....	24
4.4 Temperature requirements	24
4.5 Grounding and isolation	27
4.6 Isolation transformers	30
4.7 Additional general requirements for Canada.....	30
5. Testing requirements	31
5.1 General	31
5.2 Type tests.....	31
5.3 Routine testing.....	40
6. Marking requirements	41
6.1 Packaging	41
6.2 Insulated impedance conductor	42
6.3 Weather barrier.....	43
6.4 Guard marking requirements for systems above 30 Vac	43
7. Documentation	43
Annex A (informative) Bibliography	46
Annex B (normative) Requirements for Class I, II, and III Division 2 Hazardous (Classified) Areas.....	48
B.1 Application.....	48
B.2 General.....	48
B.3 Control and temperature requirements.....	48
B.4 Requirements for protective device in Division 2.....	49
B.5 Weather barrier requirements.....	49
B.6 Type tests	49
B.7 Marking.....	50
B.8 Instructions.....	51
Annex C (normative) Impedance heating system requirements for Class I, Zone 2; Zone 2; and Zone 22 .	52
C.1 Additions and exclusions	52
C.2 Weather barrier requirements.....	56
C.3 Additional requirements for Zone 2 areas.....	56
Annex D (normative) Impedance heating system design verification methodology.....	58
D.1 Introduction	58
D.2 Design methodology and selection of impedance heaters	58

D.3 Stabilized design calculations for the workpiece	58
D.4 Impedance heating system workpiece performance and equilibrium conditions.....	59
D.5 Heat loss calculations.....	61
D.6 Heat-loss design safety factor	61
D.7 Maximum temperature determination.....	62
Annex E (normative) Insulated impedance conductor reference tables	65
E.1 General.....	65
Annex F (normative) Formula for calculating insulation resistance.....	85
Annex G (normative) Alternative national markings	86
G.1 General.....	86
G.2 Markings on wire (Subclause 6.2)	86
G.3 Markings on packaging (Subclause 6.1).....	86

IEEE/CSA Standard for Impedance Heating of Pipelines and Equipment— General, Testing, Marking, and Documentation Requirements

1. Overview

1.1 General

This standard is divided into seven clauses that cover requirements for impedance heating when installed in ordinary locations as well as in hazardous (classified) locations. [Clause 1](#) provides the scope, purpose, and typical applications. [Clause 2](#) lists normative references to other standards that are indispensable in applying this standard. [Clause 3](#) provides definitions that are not found in other standards or have been modified for use with this standard. [Clause 4](#) establishes general system requirements for impedance heating. [Clause 5](#) provides both type and routine testing requirements for insulated impedance conductors and other impedance system components. [Clause 6](#) covers marking requirements. [Clause 7](#) details additional documentation requirements.

This standard also contains annexes. [Annex A](#) provides bibliographical references. [Annex B](#) provides requirements for installations that are in explosive atmospheres classified using the Division method of area classification. [Annex C](#) provides additional requirements in explosive atmospheres classified using the Zone method of area classification. [Annex D](#) covers impedance heating design verification methodologies. [Annex E](#) provides reference tables associated with insulated impedance conductor testing in [Clause 5](#). [Annex F](#) provides the formula for calculating insulation resistance. [Annex G](#) provides alternative national markings.

1.2 Scope

This standard applies to general, testing, marking, and documentation requirements for impedance heating systems for steel or steel alloy pipe or equipment, rated up to and including 132 Vac. These heating system components are intended for installation in accordance with CSA C22.1, Canadian Electrical Code, Part I (CE Code); NFPA 70, National Electrical Code® (NEC®) in the USA; or with any other national electrical installation code, as applicable.¹

¹ National Electrical Code and NEC are both registered trademarks of the National Fire Protection Association, Inc.