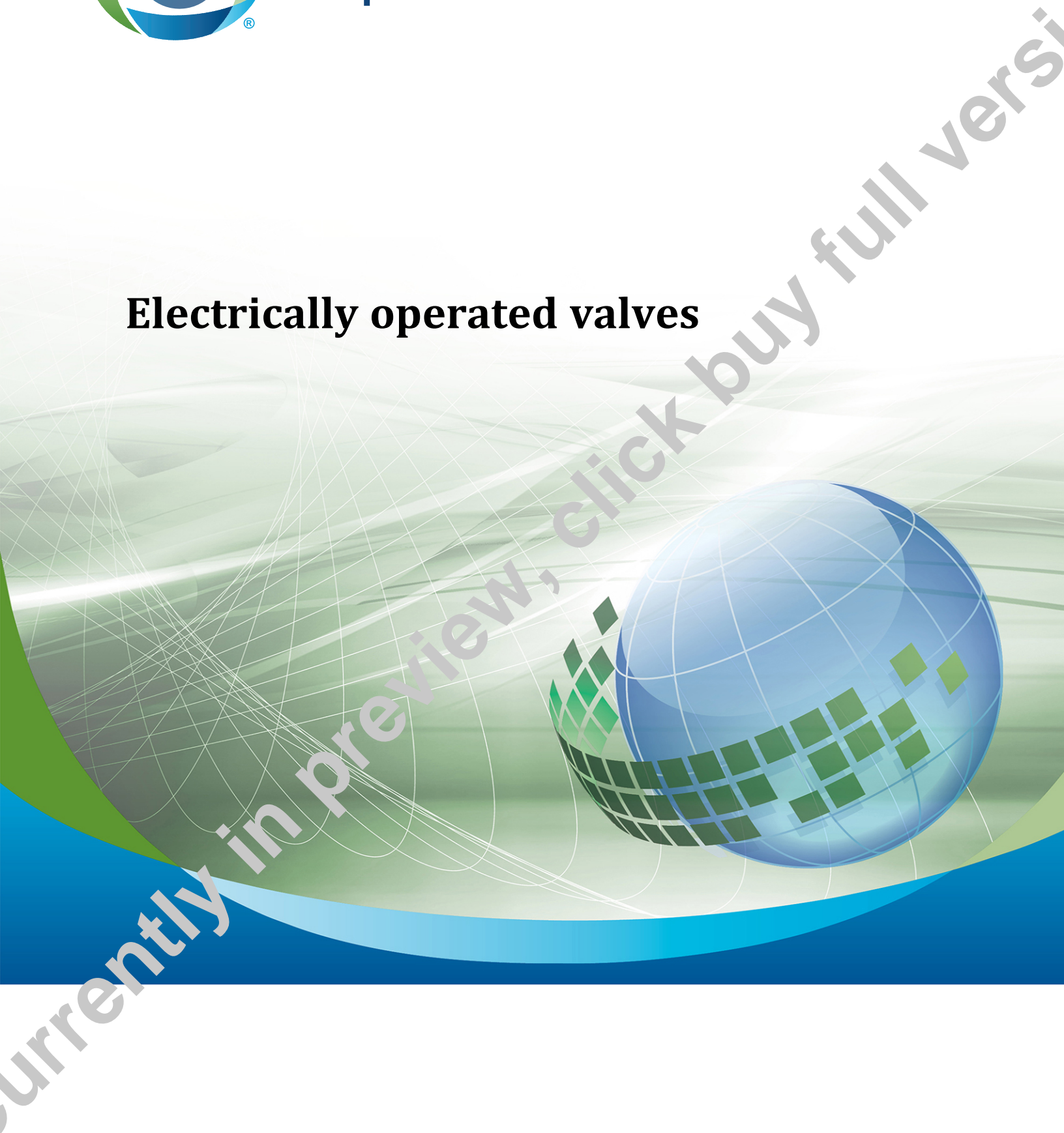




**CSA  
Group**

**CSA C22.2 No. 139:13**  
*(reaffirmed 2018)*

## **Electrically operated valves**



# 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 treaty 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 form.

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.



# ***Revision History***

**CSA C22.2 No. 139:13, Electrically operated valves**

<b>Update No. 1 — February 2016</b>	<b>Revision symbol (in margin)</b>
Clauses <a href="#">3</a> , <a href="#">7.8.1.5</a> , <a href="#">7.8.1.5.1</a> , <a href="#">7.8.1.5.2</a> , <a href="#">7.8.1.10</a> , <a href="#">7.9.3.3</a> , <a href="#">7.9.4.5</a> , <a href="#">7.15</a> , and <a href="#">7.21.2</a> Figure <a href="#">3</a>	①

Currently in preview, click buy full version

# ***Standards Update Service***

## ***CSA C22.2 No. 139:13 December 2013***

**Title:** *Electrically operated valves*

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

- go to [store.csagroup.org](http://store.csagroup.org)
- click on **CSA Update Service**

The **List ID** that you will need to register for updates to this publication is **24223-01**

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 [www.csagroup.org/legal](http://www.csagroup.org/legal) to find out how we protect your personal information.

*CSA C22.2 No. 139:13*  
***Electrically operated valves***



*®A trademark of the Canadian Standards Association, operating as "CSA Group"*

*Published in December 2013 by CSA Group  
A not-for-profit private sector organization  
178 Rexdale Boulevard, Toronto, Ontario, Canada M9W 1R3*

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

*ISBN 978-1-77139-443-7*

*© 2013 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.*

# Contents

Technical Committee on Industrial Products	4
Subcommittee on Electrically Operated Valves	6
Preface	8
<b>1 Scope</b>	<b>9</b>
<b>2 Reference publications</b>	<b>10</b>
<b>3 Definitions</b>	<b>12</b>
<b>4 General requirements</b>	<b>14</b>
<b>5 Construction</b>	<b>14</b>
5.1 General	14
5.1.4 Modular assembly	14
5.1.6 Safety functions involving electronics	15
5.2 Enclosures	15
5.2.1 General	15
5.2.2 Non-metallic materials	16
5.2.3 Thickness of non-metallic enclosures for live parts	17
5.2.4 Thickness of sheet metal enclosures for live parts	17
5.2.5 Thickness of cast enclosures for live parts	17
5.2.6 Doors and covers of enclosures	17
5.2.7 Openings in enclosures	18
5.2.8 Special-purpose enclosures	18
5.3 Mechanical assembly	18
5.4 Strength of fluid-containing parts	18
5.4.7 Valves for flammable, hazardous fluids and safety valves	20
5.5 Operation requirements	20
5.5.1 Seat leakage	20
5.5.2 External leakage	21
5.5.3 Opening and closing	21
5.6 Endurance requirements	22
5.7 Supply connections	22
5.7.1 General	22
5.7.2 Leads	23
5.8 Wiring terminal parts	23
5.9 Current-carrying parts	24
5.10 Internal wiring	24
5.11 Electrical insulation	25
5.12 Motors	25
5.12.1 General	25
5.12.2 Protection against overheating	25
5.13 Transformers	25
5.14 Switches and controls	26

5.15	Fuses and fuseholders	26
5.16	Spacings	26
5.16.1	General	26
5.16.2	Low-voltage circuits	27
5.16.3	Extra-low-voltage safety-control circuits	28
5.16.4	Extra-low-voltage Class 2 circuits	28
5.16.5	Spacings on printed circuit boards	28
5.17	Separation of circuits	29
5.17.1	Factory-installed wiring	29
5.17.2	Provision for field installation conductors	29
5.18	Grounding and bonding	30
5.19	Isolation of circuits	30
5.20	Surge suppression components	30
5.21	Components for communication applications	30
5.22	Thermal cut-off	31
<b>6</b>	<b>Marking</b>	<b>31</b>
6.1	General	31
6.2	Extra-low-voltage valves	33
6.3	Modular assembly	33
<b>7</b>	<b>Tests</b>	<b>34</b>
7.1	General	34
7.2	Test conditions	34
7.3	Rating	35
7.3.1	Input	35
7.3.2	Output	35
7.4	Temperature	35
7.5	Operation	37
7.5.1	General	37
7.5.2	Opening and closing — Safety valves	37
7.5.3	Opening and closing — General purpose valves	38
7.5.4	Operating times	38
7.6	Dielectric strength	39
7.7	Overload (control devices)	40
7.8	Endurance test	41
7.8.1	General	41
7.8.2	Control devices	44
7.9	Leakage tests	44
7.9.2	General	44
7.9.3	Test for seat leakage of liquid safety valves	45
7.9.4	Test for seat leakage of gas safety valves	45
7.9.5	Test for external leakage	46
7.10	Strength tests of fluid-containing parts	47
7.11	Impact test	48
7.12	Flame test for enclosures of live parts	48
7.12.1	General	48
7.12.2	Apparatus	49
7.12.3	Test procedure	49

7.12.4	Compliance	49
7.13	Deformation test	50
7.14	Fatigue test	50
7.14.1	Test method	50
7.14.2	Acceptance criteria	51
7.14.3	Additional requirements	51
7.15	Test for valves with valve bodies of thermoplastic material intended to be connected to the water supply downstream of the delivery point	51
7.15.1	Test method	51
7.15.2	Conditions of acceptability	51
7.16	Test for general-purpose pneumatic (air) valves with valve bodies of non-metallic material	52
7.16.1	Applicable valves for pressure envelope test	52
7.16.2	Pressure envelope test	52
7.16.3	Impact	52
7.17	Single fault condition	52
7.18	Burnout test	52
7.18.1	Test conditions	52
7.18.2	Conditions of acceptability	53
7.19	Abnormal	53
7.19.4	Conditions of acceptability	53
7.20	Printed circuit board with conformal coating	53
7.20.1	Dielectric strength on printed circuit boards	53
7.20.2	Dielectric strength after temperature conditioning	54
7.20.3	Dielectric strength after humidity conditioning	54
7.20.4	Adhesion	54
7.21	Torsion and bending moment	54

---

Annex A (informative) — Calculation of variability factor  $K_v$  68

Annex B (informative) — SI conversion factors 70

# Technical Committee on Industrial Products

<b>R.M. Bartholomew</b>	Electric Power Equipment Ltd., Vancouver, British Columbia <i>Representing Manufacturers</i>	<i>Chair</i>
<b>R.P. de Lhorbe</b>	Schneider Electric Canada, Inc., Richmond, British Columbia <i>Representing Manufacturers</i>	<i>Vice-Chair</i>
<b>D. Stefancic</b>	CSA Group, Mississauga, Ontario	<i>Project Manager</i>

## Representing Regulatory Authorities

<b>D.P. Badry</b>	Government of Yukon, Whitehorse, Yukon
<b>D.R. MacLeod</b>	Department of Labour and Advanced Education, Halifax, Nova Scotia
<b>D. Olechna</b>	Electrical Safety Authority, Mississauga, Ontario
<b>R. Pack</b>	SaskPower, Saskatoon, Saskatchewan

## Representing Manufacturers

<b>W.K. Jones</b>	Eaton, Burlington, Ontario
<b>M. Smith</b>	Rockwell Automation Canada Inc., Cambridge, Ontario

## Representing General Interests

<b>N. Mancini</b>	Mississauga, Ontario
<b>D. Mascarenhas</b>	Brampton, Ontario

**D.G. Morlidge**

Fluor Canada Ltd.,  
Calgary, Alberta

**A.Z. Tsisserev**

Stantec Consulting Ltd.,  
Vancouver, British Columbia

Currently in preview, click buy full version

# ***Subcommittee on Electrically Operated Valves***

<b>B. Morrison</b>	Toronto, Ontario	<i>Chair</i>
<b>G. Aubert-Maguéro</b>	Bernard Controls, Gonesse cedex, France	
<b>A. Bal</b>	Toronto, Ontario	
<b>K. Boehme</b>	National Fluid Power Association, Milwaukee, Wisconsin, USA	
<b>J.F. Carlin</b>	Eaton Corporation Hydraulics Operations, Searcy, Arkansas, USA	
<b>J.A. Desjarlais</b>	Underwriters Laboratories Inc., Northbrook, Illinois, USA	
<b>E. Fernando</b>	CSA Group, Mississauga, Ontario	
<b>E. Grzesik</b>	Mississauga, Ontario	
<b>D.C. Johnson</b>	Invensys Controls, Carol Stream, Illinois, USA	
<b>W.J. Loftus</b>	Asco Valve Canada, Brantford, Ontario	
<b>K. Stroes</b>	SMC Corporation of America, Noblesville, Indiana, USA	
<b>O. Walch</b>	R. Stahl Schaltgeraete GmbH, Waldenburg, Germany	
<b>T. White</b>	Rotork Controls Inc., Rochester, New York, USA	
<b>S. Wiedmann</b>	Burkert Werke GmbH, Ingelfingen, Germany	

**A. Hawley**

CSA Group,  
Mississauga, Ontario

*Project Manager*

# Preface

This is the fourth edition of CSA C22.2 No. 139, *Electrically operated valves*. It supersedes the previous editions, published in 2010, 1982, and 1973. It replaces the electrical requirements of CSA Technical Information Letter (TIL) No. D-18A, *Interim Certification Requirements for Hydraulic Control Valves Intended for Installation in Elevating Systems in Accordance With the Elevator Safety Code, CSA Standard B44*.

This Standard is one of a series of Standards issued under the *Canadian Electrical Code, Part II*.

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

Permission to use extracts from ISO/TR 10771-2:2008 was provided by Standards Council of Canada, in cooperation with IHS Canada. No further reproduction is permitted without prior written approval from Standards Council of Canada.

This Standard was prepared by the Subcommittee on Electrically Operated Valves, under the jurisdiction of the Technical Committee on Industrial 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’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.*

# CSA C22.2 No. 139:13

## ***Electrically operated valves***

### **1 Scope**

#### **1.1**

This Standard applies to electrically operated, general-purpose valves\* and safety valves\* that are intended to be used in ordinary locations in accordance with the *Canadian Electrical Code, Part I*, for the control of fluids (e.g., air, gases, oils, refrigerants, steam, water, etc.), and rated 600 V and less.

*\* For convenience, the shorter term “valve” is used where the same requirements apply to both general-purpose and safety valves.*

#### **1.2**

This Standard also applies to valves intended to be incorporated into equipment that is subject to the requirements of the *Canadian Electrical Code, Part II*.

#### **1.3**

This Standard also applies to electrically powered mechanisms that are designed to provide the signals needed for monitoring valve operation from a remote location and to electrically powered valve actuators\*, that are designed to be fitted to valves.

*\* For convenience the term valve includes valve actuator unless otherwise stated.*

#### **1.4**

This Standard contains requirements for electrical features of valves and requirements for mechanical features of valves that affect their safe operation.

#### **1.5**

This Standard does not include requirements for mechanical and operational features that do not directly affect the safe operation of a valve.

#### **1.6**

With respect to construction and tests of electrical features, the requirements of this Standard complement those of ANSI Z21.21/CSA 6.5.

#### **1.7**

This Standard does not apply to water valves of connection size larger than 2-inch pipe size or pressure rating above 1600 kPa (232 psi) for valve bodies of thermoplastic material.

#### **1.8**

Electrically operated damper actuators are evaluated to the requirements of CSA C22.2 No. 24.

#### **1.9**

The values given in SI units are the units of record for the purposes of this Standard. The values given in parentheses are for information and comparison only.