



UL 60947-4-2

STANDARD FOR SAFETY

Standard for Low-Voltage Switchgear and
Controlgear – Part 4-2: Contactors and Motor-
Starters – AC Semiconductor Motor Controllers
and Starters

UL Standard for Safety for Low-Voltage Switchgear and Controlgear – Part 4-2: Contactors and Motor-Starters – AC Semiconductor Motor Controllers and Starters, UL 60947-4-2

First edition, Dated March 21, 2014

Summary of Topics

This First Edition of ANSI/UL 60947-4-2 is a bi-national IEC-based standard covering AC Semiconductor Motor Controllers and Starters. It is based on the Edition 2.2 of IEC 60947-4-2.

Please note that the national difference document incorporates all of the national differences for UL 60947-4-2.

The new requirements are substantially in accordance with Proposal(s) on this subject dated June 22, 2012 and January 25, 2013.

All rights reserved. No part of this publication may be reproduced, stored in a retrieval system, or transmitted in any form by any means, electronic, mechanical photocopying, recording, or otherwise without prior permission of UL.

UL provides this Standard “as is” without warranty of any kind, either expressed or implied, including but not limited to, the implied warranties of merchantability or fitness for any purpose.

In no event will UL be liable for any special, incidental, consequential, indirect or similar damages, including loss of profits, lost savings, loss of data, or any other damages arising out of the use of or the inability to use this Standard, even if UL or an authorized UL representative has been advised of the possibility of such damage. In no event shall UL’s liability for any damage ever exceed the price paid for this Standard, regardless of the form of the claim.

Users of the electronic versions of UL’s Standards for Safety agree to defend, indemnify, and hold UL harmless from and against any loss, expense, liability, damage, claim, or judgment (including reasonable attorney’s fees) resulting from any error or deviation introduced while purchaser is storing an electronic Standard on the purchaser’s computer system.

The requirements in this Standard are now in effect, except for those paragraphs, sections, tables, figures, and/or other elements of the Standard having future effective dates as indicated in the preface. The prior text for requirements that have been revised and that have a future effective date are located after the Standard, and are preceded by a “SUPERSEDED REQUIREMENTS” notice.

No Text on This Page



CSA Group
CAN/CSA-C22.2 No. 60947-4-2-14
First Edition (IEC 60947-4-2:1999+A1:2001+A2:2006, MOD)



Underwriters Laboratories Inc.
UL 60947-4-2
First Edition

Low-Voltage Switchgear and Controlgear – Part 4-2: Contactors and Motor-Starters – AC Semiconductor Motor Controllers and Starters

March 21, 2014

This standard is based on IEC 60947-4-2, edition 2.2 (2007), which is based on the second edition (1999), its amendment 1 (2001), its amendment 2 (2006), and its corrigendum of March 2002.



ANSI/UL 60947-4-2-2014

Approved by



Standards Council of Canada
Conseil canadien des normes

This is a preview. [Click here to purchase the full publication.](#)

Commitment for Amendments

This standard is issued jointly by the Canadian Standards Association (operating as “CSA Group”) and Underwriters Laboratories Inc. (UL). Comments or proposals for revisions on any part of the standard may be submitted to CSA Group or UL at anytime. Revisions to this standard will be made only after processing according to the standards development procedures of CSA Group and UL. CSA Group and UL will issue revisions to this standard by means of a new edition or revised or additional pages bearing their date of issue.

ISBN 978-1-55491-994-9 © 2014 CSA Group

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

This Standard is subject to review 5 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 inquires@csagroup.org and include “Proposal for change” in the subject line: Standard designation (number); relevant clause, table, and/or figure number; wording of the proposed change; and rationale for the change.

To purchase CSA Group Standards and related publications, visit CSA Group’s Online Store at shop.csa.ca or call toll-free 1-800-463-6727 or 416-747-4044.

Copyright © 2014 Underwriters Laboratories Inc.

UL’s Standards for Safety are copyrighted by UL. Neither a printed nor electronic copy of a Standard should be altered in any way. All of UL’s Standards and all copyrights, ownerships, and rights regarding those Standards shall remain the sole and exclusive property of UL.

This ANSI/UL Standard for Safety consists of the First Edition. The most recent designation of ANSI/UL 60947-4-2 as an American National Standard (ANSI) occurred on March 21, 2014. ANSI approval for a standard does not include the Cover Page, Transmittal Pages, Title Page (front and back), or the Preface. The National Difference Page and IEC Foreword are also excluded from the ANSI approval of IEC-based standards.

Comments or proposals for revisions on any part of the Standard may be submitted to UL at any time. Proposals should be submitted via a Proposal Request in UL’s On-Line Collaborative Standards Development System (CSDS) at <http://csds.ul.com>.

To purchase UL Standards, visit Comm 2000 at http://www.comm-2000.com/help/how_to_order.aspx or call toll-free 1-888-853-3503.

CONTENTS

PREFACE	7
NATIONAL DIFFERENCES	10
FOREWORD	11
INTRODUCTION	13
1 Scope and object	14
2 Normative references	15
3 Definitions, symbols and abbreviations	17
3.1 Definitions concerning a.c. semiconductor motor control devices	18
3.2 EMC definitions	24
3.3 Symbols and abbreviations	25
4 Classification	25
5 Characteristics of a.c. semiconductor motor controllers and starters	25
5.1 Summary of characteristics	25
5.2 Type of equipment	26
5.3 Rated and limiting values for main circuits	27
5.4 Utilization category	34
5.5 Control circuits	35
5.6 Auxiliary circuits	36
5.7 Characteristics of relays and releases (overload relays)	36
5.8 Co-ordination with short-circuit protective devices (SCPD)	39
6 Product information	39
6.1 Nature of information	39
6.2 Marking	41
6.2DV.1 Markings	41
6.2DV.2 Motor controller markings	42
6.2DV.3 Overload relay markings	43
6.2DV.4 Combination motor controller markings	44
6.3 Instructions for installation, operation, and maintenance	45
7 Normal service, mounting and transport conditions	45
7.1 Normal service conditions	45
7.2 Conditions during transport and storage	46
7.3 Mounting	46
7.4 Electrical system disturbances and influences	46
8 Constructional and performance requirements	46
8.1 Constructional requirements	46
8.1DV.1 Constructional requirements	46
8.1DV.2 Combination motor controllers	47
8.2 Performance requirements	48
8.3 EMC requirements	69
9 Tests	73
9.1 Kinds of tests	73
9.2 Compliance with constructional requirements	76
9.3 Compliance with performance requirements	76
9.3.4DV.1 Enclosure	95
9.3.4.3DV.1 Selection of SCPD	98
9.3.4.3DV.2 Sample selection for overload relay	99

9.3.4.3.1DV.1 Standard fault current circuits	99
9.3.4.3.1DV.2 High available fault currents (Optional)	101
9.3.4.3.1DV.3 Protective devices	101
9.3.4.3.1DV.4 Procedure	102

Annex A (normative) Marking and identification of terminals

A.1 General	109
A.2 Marking and identification of terminals of semiconductor controllers and starters	109
A.2.1 Marking and identification of terminals of main circuits	109
A.2.2 Marking and identification of terminals of control circuits	109
A.2.3 Marking and identification of auxiliary circuits	110
A.3 Marking and identification of terminals of overload relays	115

Annex B Vacant

Annex C (normative) Co-ordination at the crossover current between the starter and associated SCPD

C.1 Scope	118
C.2 General and definitions	118
C.2.1 General	118
C.2.2 Definitions	118
C.3 Condition for the test for the verification of co-ordination at the crossover current by a direct method	118
C.4 Test currents and test circuits	118
C.5 Test procedure and results to be obtained	119
C.5.1 Test procedure	119
C.5.2 Results to be obtained	119
C.6 Verification of co-ordination at the crossover current by an indirect method	119
C.6.1 General	119
C.6.2 Test for I_{cd}	120
C.6.3 Time-current characteristic withstand capability of controllers/starters	120

Annex D (normative) Requirements for radiated emission testing

D.1 Characteristics of controllers and starters	122
D.2 Radiated emissions	122
D.2.1 Main power circuits	122
D.2.2 Control and auxiliary circuits	123

Annex E (informative) Method of converting CISPR 11 radiated emission limits to transmitted power equivalents

Annex F (informative) Operating capability

Annex G (informative) Examples of control circuit configurations

G.1	External control device (ECD)	129
G.1.1	Definition of an ECD	129
G.1.2	Diagrammatic representation of an ECD	129
G.1.3	Parameters of an ECD	129
G.2	Control circuit configurations	130
G.2.1	Controllers with external control supply	130
G.2.2	Controllers with an internal control supply and control input only	131

Annex H (informative) Items subject to agreement between manufacturer and user

Annex I (normative) Modified test circuit for short-circuit testing of semiconductor motor controllers and starters

Annex J (informative) Flowchart for constructing bypassed semiconductor controllers tests

Annex K (normative) Extended functions within electronic overload relays

K.1	Scope	138
K.1.1	General	138
K.1.2	Residual current function	138
K.2	Definitions	138
K.3	Classification of electronic overload relays	139
K.4	Type of relays	139
K.5	Performance requirements	139
K.5.1	Limits of operation of residual current electronic overload relays	139
K.5.2	Limits of operation of residual current sensing electronic relays Type B	139
K.5.3	Limits of operation of voltage asymmetry relays	140
K.5.4	Limits of operation of phase reversal relays	140
K.5.5	Limits of operation of current asymmetry relays	140
K.5.6	Limits of operation of over-voltage relays and releases	140
K.6	Tests	140
K.6.1	Limits of operation of residual current sensing electronic relays Type A	140
K.6.2	Limits of operation of residual current sensing electronic relays Type B	141
K.6.3	Current asymmetry relays	141
K.6.4	Voltage asymmetry relays	142
K.6.5	Phase reversal relays	142
K.6.6	Over-voltage relays	142
K.7	Routine and sampling tests	142

Annex DVA (normative) Devices Rated in Watts Horsepower**Annex DVB (normative) Reference Standards****Annex DVC (informative) Standards for Components****Annex DVD (normative) Clearances and Creepage Distances for AC Semiconductor Motor Controllers and Starters**

DVD.1 General	148
DVD.2 Determination of clearances and creepage distances	148
DVD.3 Spacings within an enclosure	150

Annex DVE (normative) Operations Tests for Solid State Motor Controllers with Reduced Voltage Starting Feature

DVE.1 In Canada Annex DVE is informative.	151
DVE.2 Controller overload	152
DVE.3 Single phasing	152
DVE.4 Inoperative blower motor	152
DVE.5 Clogged filter	152
DVE.6 Current limiting control	152