C22.2 No. 282-13

CSA Group

Plugs, receptacles, and couplers for electric vehicles

currently in preview, click buy full versi

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.

CSA Group

currently in preview, click buy full version

Standards Update Service

C22.2 No. 282-13
February 2013

Title: *Plugs, receptacles, and couplers for electric vehicles*
Pagination: 74 pages, each dated **February 2013**

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

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

The **List ID** that you will need to register for updates to this publication is **2422472**.

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

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

currently in preview, click buy full versi

currently in preview, click buy full versi

Association of Standardization and Certification
NMX-J-678-ANCE-2013
First Edition

CSA Group
CSA C22.2 No. 282-13
First Edition

Underwriters Laboratories Inc.
UL 2251
Third Edition

Standard for Plugs, Receptacles, and Couplers for Electric Vehicles

February 22, 2013

currently in preview, click buy full versi

ANSI/UL 2251-2013

Commitment for Amendments

This standard is issued jointly by the Association of Standardization and Certification (ANCE), 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 ANCE, CSA Group, or UL at any time. Revisions to this standard will be made only after processing according to the standards development procedures of ANCE, 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. ANCE will incorporate the same revisions into a new edition of the standard bearing the same date of issue as the CSA Group and UL pages.

Copyright © 2013 ANCE

Rights reserved in favor of ANCE.

ISBN 978-1-55491-818-8 © 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.

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.

This Standard is subject to periodic review, 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.

Copyright © 2013 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 Third Edition.

The most recent designation of ANSI/UL 2251 as an American National Standard (ANSI) occurred on February 22, 2013. ANSI approval for a standard does not include the Cover Page, Transmittal Pages, Title Page (front and back), or the Preface.

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.

currently in preview, click buy full versi

CONTENTS

Preface 6

INTRODUCTION

1 Scope 8
2 Definitions 8
3 Components 10
4 Units of Measurement 10
5 Normative References 10

CONSTRUCTION

6 General 11
7 Configurations 11
8 Insulating Materials 11
8.1 Flammability 11
8.2 Electrical properties 12
8.3 Thermal properties 13
9 Protection against Corrosion 13
10 Enclosures 14
10.1 General 14
10.2 Mechanical strength 14
10.3 Nonmetallic enclosures 14
10.4 Metallic enclosures 15
10.5 Plug, vehicle connector, and breakaway coupling enclosures 15
10.6 Environmental enclosures 15
11 Current-Carrying Parts 15
12 Clearances and Creepage Distances 16
13 Accessibility of Live Parts 17
14 Grounding 19
15 Grounding Connections 20
16 Isolation 21
17 Terminal Parts 21
18 Contacts 22
19 Assembly 22
20 Separation of Circuits 23
20.1 Factory wiring 23
20.2 Separation barriers 23
20.3 Field wiring 24
21 Devices Intended to Accommodate a Fuse 24
22 Cable Grip 25
23 Sharp Edges 26

PERFORMANCE

24 Representative Devices 26
25 Accelerated Aging Tests 28
25.1 Rubber compounds 28
25.2 PVC compounds 29
26 Mold Stress Relief Test 29

Currently in preview, click buy full version

27 Moisture Absorption Resistance 29
28 Humidity Conditioning 30
29 Insulation Resistance Test 31
30 Dielectric Withstand Test 31
31 Dew Point Test 32
32 Conductor Secureness and Pullout Test 32
33 Cable Secureness Test 33
34 Impact Test (Plugs, Vehicle Connectors, and Breakaway Couplings) 34
35 Crush Test 36
36 Vehicle Driveover Test 37
37 Withdrawal Force Test 38
37.1 Plugs and receptacles, vehicle connectors, and vehicle inlets 38
37.2 Breakaway couplings 39
38 Grounding Path Current Test 39
39 Short Circuit Test 40
39.1 General 40
39.2 Protective devices 40
39.3 Calibration of test circuits 43
40 Strength of Insulating Base and Support Test 48
41 No-Load Endurance Test 49
42 Endurance with Load Test 49
43 Overload Test 50
44 Electromagnetic Test (Pilot Contacts) 51
45 Temperature Rise Test 52
46 Fuseholder Temperature Test 53
47 Surface Temperatures 54
48 Resistance to Arcing Test 55
49 Polarization Integrity Test 55
50 Resistance to Corrosion Test 55
51 Vibration Test 56
52 Accelerated Aging Gasket Test 56
53 Permanence of Marking Tests (Mexico and US) 58
54 Enclosure Tests for Environmental Protection 58

RATINGS

55 General 60

MARKINGS

56 General 60
56.1 Company name, catalog designation, electrical rating 60
56.2 Multiple factories 62
56.3 Nonconductive mounting means 62
56.4 Disconnecting use only 62
56.5 AC only devices 62
56.6 Cover grounded devices 62
56.7 Fused devices 62
56.8 Locking-type devices 63
56.9 Receptacle marking location 63
56.10 Wiring information – field wiring terminals 63
56.11 Overcurrent protection 64
56.12 Environmental enclosures 64

currently in preview, click buy full versi

56.13 HB flammability use marking (Canada only) 65
56.14 EV cable assembly markings 65
57 Identification and Marking of Terminals 65
57.1 General 65
57.2 Grounded and grounding 65
57.3 Other terminals 68

Annex A – Reference Standards (Normative)

Annex B – French and Spanish Translations (Informative)

B1 French and Spanish Translations 73

currently in preview, click buy full versi

Preface

This is the harmonized ANCE, CSA Group, and UL Standard for Plugs, Receptacles, and Couplers for Electric Vehicles. It is the First edition of NMX-J-678-ANCE, the First edition of CSA C22.2 No. 282, and the Third edition of UL 2251.

This harmonized standard was prepared by the Association of Standardization and Certification (ANCE), CSA Group, and Underwriters Laboratories Inc. (UL). The efforts and support of the Technical Harmonization Working Group for Electric Vehicle Couplers are gratefully acknowledged.

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

The present Mexican Standard was reviewed and approved by the Comité de Normalización de la Asociación de Normalización y Certificación, A.C., CONANCE.

This standard was reviewed by the CSA Subcommittee on Electrical Vehicle Safety of Plugs, Receptacles, and Couplers, 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.

This standard has been approved by the American National Standards Institute (ANSI) as an American National Standard.

Where reference is made to a specific number of specimens to be tested, the specified number is to be considered a minimum quantity.

Note: 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.

Level of harmonization

This standard uses the IEC format but is not based on, nor is considered equivalent to, an IEC standard.

This standard is published as an equivalent standard for ANCE, CSA Group, and UL.

An equivalent standard is a standard that is substantially the same in technical content, except as follows: Technical national differences are allowed for codes and governmental regulations as well as those recognized as being in accordance with NAFTA Article 905, for example, because of fundamental climatic, geographical, technological, or infrastructural factors, scientific justification, or the level of protection that the country considers appropriate. Presentation is word for word except for editorial changes.

Reasons for differences from IEC

This standard provides general requirements for plugs, receptacles, and couplers for electric vehicles in accordance with the electrical installation codes of Canada, Mexico, and the United States. At present there is no IEC standard for these products for use in accordance with these codes. Therefore, this standard does not employ any IEC standard for base requirements.

Currently in preview, click buy full version

Interpretations

The interpretation by the standards development organization of an identical or equivalent standard is based on the literal text to determine compliance with the standard in accordance with the procedural rules of the standards development organization. If more than one interpretation of the literal text has been identified, a revision is to be proposed as soon as possible to each of the standards development organizations to more accurately reflect the intent.

ANCE effective date

The effective date for ANCE will be announced through the Diario Oficial de la Federación (Official Gazette) and is indicated on the cover page.

CSA Group effective date

The effective date for CSA Group will be announced through *CSA Informs* or a CSA Group certification notice.

UL effective date

As of February 22, 2013, all products Listed or Recognized by UL must comply with the requirements in this Standard.

A UL effective date is one established by Underwriters Laboratories Inc. and is not part of the ANSI approved standard.

INTRODUCTION

1 Scope

1.1 These requirements cover plugs, receptacles, vehicle inlets, vehicle connectors, and breakaway couplings, rated up to 800 amperes and up to 600 volts ac or dc, intended for conductive connection systems, for use with electric vehicles. These devices are for use in either indoor or outdoor nonhazardous locations in accordance with Annex A, Ref. No. 1.

1.2 This Standard does not directly apply to the following:

a) Devices produced integrally with flexible cord or cable that are covered by Annex A, Ref. No. 2;

b) Devices solely intended for direct connection to the branch circuit in accordance with Annex A, Ref. No. 1 such as attachment plugs, cord connectors, and receptacles, which can include 3 or more pilot contacts, that are covered by Annex A, Ref. No. 3;

c) Single and multi-pole connectors, intended for connection to copper conductors, for use in data, signal, control, and power applications within and between electrical equipment, where exposed, for use in accordance with national electrical codes, that are covered by Annex A, Ref. No. 4;

d) Devices of the pin and sleeve type construction, intended to provide power from branch circuits to utilization equipment, or for direct connection of utilization equipment to the branch circuit, that are covered by Annex A, Ref. No. 5;

e) Devices intended for use in hazardous locations that are covered by Annex A, Ref. No. 6;

f) Devices consisting of wiring terminals and supporting blocks intended for the connection of wiring that are covered by Annex A, Ref. No. 7;

g) Devices such as modular jacks and plugs that are intended for use with telecommunications networks, that are covered by Annex A, Ref. Nos. 8 and 9;

h) Devices such as wire connectors and soldering lugs that are covered by Annex A, Ref. Nos. 10 – 12;

i) Devices such as quick-connect terminals that are covered by Annex A, Ref. No. 13;

j) Products such as power outlet assemblies that are covered by Annex A, Ref. No. 14;

k) Products such as switched interlocks that are covered by Annex A, Ref. No. 15.

1.3 In the text of this Standard, the term ″device″ refers to any product covered by this Standard. The letters ″EV″ refer to an electric vehicle, including plug-in hybrid vehicles, hybrid vehicles, electric vehicles, battery electric vehicles, and similar vehicles.

2 Definitions

2.1 For the purposes of this Standard, the following definitions apply.