CSA Group
CSA C22.2 No. 342:22
First Edition

Underwriters Laboratories Inc.
UL 486L
First Edition

Large Ferrules

March 25, 2022

Approved American National Standard

ANSI/UL 486L-2022

Standard for Safety for Large Ferrules

First Edition, Dated March 25, 2022

Summary of Topics

The is the First edition of the Standard for Large Ferrules, dated March 25, 2022 and applies to bare and covered ferrules intended for field wiring and factory wiring for use.

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 978-1-4883-3904-2 © 2022 Canadian Standards Association

This Standard is subject to review within 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 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 www.csagroup.org/store/ or call toll-free 1-800-463-6727 or 416-747-4044.

This ANSI/UL Standard for Safety consists of the First Edition.

The most recent designation of ANSI/UL 486L as an American National Standard (ANSI) occurred on March 25, 2022. 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 https://csds.ul.com.

To purchase UL Standards, visit UL's Standards Sales Site at http://www.shopulstandards.com/HowToOrder.aspx or call toll-free 1-888-853-3503.

CONTENTS

No Text on This Page

PREFACE

This is the harmonized CSA Group and UL standard for Large Ferrules. It is the first edition of CSA C22.2 No. 342 and the first edition of UL 486L.

This harmonized standard was prepared by CSA Group and Underwriters Laboratories Inc. (UL). The efforts and support of the Technical Harmonization Subcommittee, CANENA Technical Harmonization Committee 99 – Electrical Connectors of the Council on the Harmonization of Electrotechnical Standards of the Nations of the Americas (CANENA), are gratefully acknowledged.

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

This standard was reviewed by the CSA Integrated Committee on Electrical Connectors, 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 developed in compliance with the Standards Council of Canada requirements for National Standards of Canada. It has been published as a National Standard of Canada by CSA Group.

Application of Standard

Where reference is made to a specific number of samples 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 it considered equivalent to, an IEC standard.

This standard is published as an equivalent standard for 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

At present there is no IEC standard for large ferrules. Therefore, this standard does not employ any IEC standard for base requirements.

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.

No Text on This Page

1 Scope

1.1 This standard applies to bare and covered ferrules intended for field wiring and factory wiring for use in accordance with the National Electrical Code, ANSI/NFPA-70, and Canadian Electrical Code, Part I, CSA C22.1.

1.2 Ferrules covered by this standard are intended to facilitate the connection of stranded wire onto devices, such as terminal blocks and mechanical wire connectors, and to treat stripped wire and prevent turned back strands during installation.

1.3 These ferrules are intended to be terminated in wire connection devices rated for copper Class B and C conductors.

1.4 These ferrules are suitable for use with 2/0 AWG to 750 kcmil, 70 mm^2 to 380 mm^2 copper conductors that are more finely stranded than Class B or C conductors.

Note: Examples of stranding classes more finely stranded than class B or C are classes G, H, I, K, M, DLO, 5, and 6.

1.5 These ferrules are intended for use in aluminum and copper body mechanical connectors with dome and conical shaped screws that apply direct pressure to the conductor being terminated.

1.6 These ferrules are not intended for use in other types of connectors, including, but not limited to, IDC (insulation displacement connection) connectors.

1.7 This standard does not apply to wire connectors such as pin adapters covered in CAN/CSA C22.2 No. 65 / UL 486A-486B.

2 Reference Publications

2.1 Where reference is made to other publications, such reference shall be considered to refer to the latest edition and any revisions thereto.

CSA Group

C22.1:21
Canadian Electrical Code, Part I

C22.2 No. 0:20
General requirements – Canadian Electrical Code, Part II

CAN/CSA-C22.2 No. 0.17 (R2018)
Evaluation of Properties of Polymeric Materials

CAN/CSA-C22.2 No. 65-18
Wire Connectors

UL Standards

UL 94
Tests for Flammability of Plastic Materials for Parts in Devices and Appliances

UL 486A-486B
Wire Connectors

UL 746C
Polymeric Materials – Use in Electrical Equipment Evaluations

UL 1694
Tests for Flammability of Small Polymeric Component Materials

NFPA (National Fire Protection Association) Standards

NFPA 70
National Electrical Code

3 Definitions

3.1 Covered – Encased within material of composition or thickness that is not recognized as electrical insulation.

3.2 Ferrule – A conductive sleeve used to facilitate the termination of stranded wire in devices rated to terminate copper Class B and C conductors.

3.3 Plastic Sleeve – A non-conductive plastic material used for identification purposes.

4 General

4.1 The values given in SI (metric) units are normative, except for AWG / kcmil conductor sizes. Any other values are for information and comparison only.

4.2 General requirements applicable to these products are provided in CAN/CSA-C22.2 No. 0.

5 Symbols and Abbreviations

5.1 ° – Degree

5.2 AWG – American Wire Gage/gauge

5.3 C – Celsius

5.4 mm^2 – Square millimeters

5.5 V – Volts

5.6 A – Amps

6 Construction Requirements

6.1 General

6.1.1 A ferrule shall be provided with one opening to accept one stranded type of copper conductor applied with compression tooling.

6.1.2 A ferrule shall comply with the dimensional requirements in Table 1 and Figure 1 and Figure 2. Longer lengths are permitted.

6.2 Materials

6.2.1 A ferrule shall be of copper or a copper alloy containing at least 80 % copper and be coated with tin.

6.3 Flammability

6.3.1 The covering material shall comply with one of the following requirements for flammability:

a) Have a minimum flammability classification of HB as determined by tests described in UL 94 or CAN/CSA-C22.2 No. 0.17. This flammability classification may be determined at the minimum thickness employed in the construction or a nominal thickness of 0.8 mm (0.031 in), whichever is greater.

b) Meet the glow wire test as specified in UL 746C or CAN/CSA-C22.2 No. 0.17 for a temperature of 650 °C; or

c) Be evaluated and classed with a flammability rating of SC-0, SC-1, SC-TC 0, or SC-TC 1 in accordance with UL 1694.

6.4 Thermal properties

6.4.1 A polymeric material used for covering shall have a minimum relative thermal index (RTI) of 80 °C (176 °F) (electrical, mechanical strength, and mechanical with impact). The material shall be evaluated using the specimen thickness employed in the covering or a nominal thickness of 0.8 mm (0.031 in), whichever is greater. The electrical RTI value may be determined regardless of the color used for the plastic sleeve.

7 Test Requirements

7.1 General

7.1.1 All ferrules shall comply with the test requirements in 7.2. Covered ferrules shall additionally comply with the test requirements in 7.3 through 7.4.

7.2 Tensile test

7.2.1 During testing in accordance with 9.2, the conductor shall not visibly move within the ferrule or be pulled out of the ferrule.

7.3 Mold stress relief

7.3.1 As a result of conditioning as specified in 9.3, there shall not be any warpage, shrinkage or other distortion that results in interference with the operation, function, or installation of the device.

7.4 Dielectric voltage-withstand

7.4.1 The plastic sleeve of a covered ferrule shall withstand the applied potential without breakdown when tested in accordance with 9.4.

8 Sampling Requirements

8.1 Samples

8.1.1 The number of samples required for each test shall be as described in 8.2 through 8.4.

8.2 Tensile test

8.2.1 Three samples shall be tested for each of the assemblies in 9.1.1.

8.2.2 Testing on shorter ferrule lengths represents longer ferrules when all other dimensions are identical.

8.3 Mold stress test

8.3.1 Six samples shall be tested for each of the assemblies in 9.1.1.

8.4 Dielectric voltage-withstand

8.4.1 The same samples subjected to the mold stress test shall then be subjected to the Dielectric voltage-withstand test.

9 Test Methods

9.1 General

9.1.1 A ferrule shall be assembled to the following conductors in the intended manner using the identified tooling and strip length [see 10.1.1 e) and f)]:

a) Largest size conductor with highest stranding count;

b) Largest size conductor with lowest stranding count;

c) Smallest size conductor with highest stranding count; and

d) Smallest size conductor with lowest stranding count.

9.2 Tensile test

9.2.1 The conductor shall be inserted through a hole in a plate that is securely fastened to a tensile machine. Insulation can be removed to perform the tensile test. The plate may separate to allow insertion of the conductor through the hole.

9.2.2 A minimum force in accordance with Table 2 shall be applied at a rate not to exceed 25.4 mm per min (1 inch per minute). The force shall be applied for 1 minute.

9.3 Mold stress test

9.3.1 Fully assembled ferrules shall be placed in a circulating-air oven for seven hours. The temperature shall be maintained at a uniform temperature of not less than 90 °C (194 °F).

9.3.2 The assembled ferrules shall be removed from the oven and allowed to cool to room temperature before determining compliance.

9.3.3 The connector shall be subjected to and comply with the dielectric voltage withstand test in 9.4.

9.4 Dielectric voltage-withstand test

9.4.1 After completing the mold stress test, assembled samples shall be subjected to a test potential of 1000 V ac for a period of 1 minute. Each sample shall be embedded in No. 7-1/2 conductive shot that is to serve as the outer electrode (see Figure 3). Only that portion of the plastic sleeve that covers current-carrying parts shall be covered with the outer electrode. A smaller than No. 7-1/2 (higher size number) shot may be used with the concurrence of those concerned. Conductive metal foil shall be used as the outer electrode when the ferrule has openings that will allow entry of the shot.

10 Marking, Labeling, Installation Instructions and Packaging

10.1 General

10.1.1 The following shall appear on or with the smallest package:

a) Manufacturers name, trademark, or trade name;

b) A distinctive catalog number or the equivalent;

c) Wire type (CU or Copper), and size(s) (AWG/mm^2);

d) Stranding type, (e.g., Class K, ...);

e) Installation tool, manufacturer's name and catalog number;

f) Strip length;

g) For covered ferrules only: "Plastic sleeve for covered ferrules is for identification purposes only and it is not electrical insulation", or equivalent; and

h) The statement: "When used in equipment with short circuit ratings, refer to the ferrules installation instructions", or equivalent.

10.2 Installation instructions

10.2.1 These ferrules are intended for installation using only crimping tools as specified by the ferrule's manufacturer.

10.2.2 The following information shall be provided in the form of instructions included in the smallest unit package:

a) These ferrules are intended for use with dome and conical shaped screws that apply direct pressure to the conductor being terminated;

b) Manufacturer's name and catalog number of the installation tools that are used to assemble the ferrules; and

c) These ferrules may be used with equipment having short circuit ratings of:

1) 85 000 A maximum, or

2) 100 000 A maximum if supplied by an overcurrent protective device, and the equipment short-circuit current rating, divided by the number of conductors per phase, results in a current of 50 000 A or less per conductor.

10.2.3 As an alternative to 10.2.2, information can be made by cross-media documentation (e.g. QR -codes with reference to internet, electronic catalogs, web-link on the package unit or delivery papers, etc.).

Table 1
Dimensional requirements

(Clause 6.1.2)

Conductor cross-section		d_1	d_2	l_1	l_2	s
AWG	mm^2	± 1.0	Min.	Min.	Min.	± 1.0
2/0		12.1	13.6	17.5	16	0.4
	70	13.5	15.0	17.5	16	0.4
3/0		14.2	15.7	23.5	22	0.4
	95	14.7	16.2	23.5	22	0.4
4/0		15.0	16.5	23.5	22	0.5
	120	16.6	18.1	23.5	22	0.5
250		17.3	18.8	23.5	22	0.5
262		17.3	18.8	23.5	22	0.5
	150	18.6	20.1	26.5	25	0.5
300		19.1	20.6	26.5	25	0.5
313		19.1	20.6	26.5	25	0.5
350		20.5	22.0	26.5	25	0.6
	185	20.8	22.3	26.5	25	0.6
373		20.5	22.0	26.5	25	0.6
400		22.5	24.0	29.5	28	0.6
444		22.5	24.0	29.5	28	0.6
	240	23.0	24.5	29.5	28	0.6
500		23.7	25.2	29.5	28	0.6
535		23.7	25.2	29.5	28	0.6
	300	26.2	27.7	33.5	32	0.7
600		26.2	27.7	33.5	32	0.7
646		26.2	27.7	33.5	32	0.7
750		29	30.5	33.5	34	0.7
Note – All dimensions in mm unless otherwise stated.						