ANSI/CAN/UL 3741:2020

JOINT CANADA-UNITED STATES
NATIONAL STANDARD

STANDARD FOR SAFETY

Photovoltaic Hazard Control

Approved American National Standard

ANSI/UL 3741-2020

SCC FOREWORD

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UL Standard for Safety for Photovoltaic Hazard Control, ANSI/CAN/UL 3741

First Edition, Dated December 8, 2020

Summary of Topics

This First Edition of ANSI/CAN/UL 3741, Standard for Photovoltaic Hazard Control, has been issued to reflect the latest ANSI and SCC approval dates, and to incorporate the proposals dated March 6, 2020 and September 18, 2020.

The new requirements are substantially in accordance with Proposal(s) on this subject dated March 6, 2020 and September 18, 2020.

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DECEMBER 8, 2020

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Standard for Photovoltaic Hazard Control

First Edition

December 8, 2020

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

The most recent designation of ANSI/UL 3741 as an American National Standard (ANSI) occurred on December 8, 2020. ANSI approval for a standard does not include the Cover Page, Transmittal Pages, Title Page, Preface or SCC Foreword.

This standard has been designated as a National Standard of Canada (NSC) on December 8, 2020.

No Text on This Page

CONTENTS

Preface **5**

INTRODUCTION

1 Scope 9
1.1 Introduction 9
1.2 Equipment and conditions included in scope 9
1.3 Equipment and conditions excluded from scope[1] 10
2 Components and Equipment 11
3 Units of Measurement 11
4 Undated References 11
5 Referenced Publications 11
6 Glossary 12

CONSTRUCTION

7 Array Component Requirements – PVHCS Requirements 15
8 Protection Requirements 17
8.1 Basis of requirements 17
8.2 Application of requirements 17
9 Protective Elements 18
9.1 General 18
9.2 PV circuit-interrupting device 18
9.3 System or equipment ground circuit interrupting or attenuation 18
9.4 Protection by enhanced protection from live parts 18
9.5 Limited access to live parts of different voltages 19
10 Fire Fighter (FF) Current Path Resistance Determination 19
10.1 Body resistance 19
10.2 Personal protective equipment (PPE) resistance 19
10.3 Water spray conductivity 20
11 Indication Systems 20
12 Safety Analysis 20
12.1 General 20
12.2 Safety analysis steps 22
12.3 Fire fighter (FF) PV array interactions 27

PERFORMANCE

13 General 29
14 PVHC System Conditioning 29
14.1 Potential damage from FF operations 29
14.2 Damage from FF tool 30
14.3 Damage from falling FF 34
14.4 Damage from FF step, walk or crawl 37
15 Hazard Exposure 39
15.1 FF impedance circuits 39
15.2 Source test circuits 39
15.3 Leakage current tests 40

MANUFACTURING AND PRODUCTION TESTS

16 General 44

MARKINGS

17 General 44

INSTRUCTIONS

18 General 44

ANNEX A (Normative) – SAFETY ANALYSIS

ANNEX B (Normative) – COMMON CONSTRUCTION DETAILS INCLUDING ASSOCIATED RISK LEVELS

ANNEX C (Informative) – FRENCH TRANSLATIONS FOR MARKING

ANNEX D (Normative) – Resistance Tables

ANNEX E (Informative) – EXAMPLE WORKSHEETS FOR PERFORMING A RISK ASSESSMENT

ANNEX F (Informative) – PVHC SAFETY ANALYSIS EXAMPLES

F.1 General 67
F.2 Part 1, section 12.2.2 67
F.3 Part 2, section 12.2.3 67
F.4 Example 69

Preface

This is the First Edition of ANSI/CAN/UL 3741 Standard for Photovoltaic Hazard Control.

UL is accredited by the American National Standards Institute (ANSI) and the Standards Council of Canada (SCC) as a Standards Development Organization (SDO).

This Standard has been developed in compliance with the requirements of ANSI and SCC for accreditation of a Standards Development Organization.

This ANSI/CAN/UL 3741 Standard is under continuous maintenance, whereby each revision is approved in compliance with the requirements of ANSI and SCC for accreditation of a Standards Development Organization. In the event that no revisions are issued for a period of four years from the date of publication, action to revise, reaffirm, or withdraw the standard shall be initiated.

In Canada, there are two official languages, English and French. All safety warnings must be in French and English. Attention is drawn to the possibility that some Canadian authorities may require additional markings and/or installation instructions to be in both official languages.

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.

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This Edition of the Standard has been formally approved by the UL Standards Technical Panel (STP) on Photovoltaic Hazard Control, STP 3741.

This list represents the STP 3741 membership when the final text in this standard was balloted. Since that time, changes in the membership may have occurred.

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This Standard is intended to be used for conformity assessment.

The intended primary application of this standard is stated in its scope. It is important to note that it remains the responsibility of the user of the standard to judge its suitability for this particular application.

CETTE NORME NATIONALE DU CANADA EST DISPONIBLE EN VERSIONS FRANÇAISE ET ANGLAISE

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INTRODUCTION

1 Scope

1.1 Introduction

1.1.1 Fire fighters (FF) performing operations involving buildings with attached or integrated Photovoltaic (PV) arrays may be exposed to electrical hazards from damaged PV equipment. These requirements provide a means for evaluation of PV Hazard Control components, equipment and systems that provide a reduced level of shock hazard from energized PV system equipment and circuits located within the PV array after the operation of hazard control initiation function(s) where required, such as but not limited to any PV Rapid Shutdown Equipment (PVRSE) or PV Rapid Shutdown Systems (PVRSS) that comply with UL 1741 in the United States and CSA C22.2 No 330 in Canada.

NOTE: Damaged PV equipment in arrays includes damage as a result of fire fighter (FF) interaction as identified throughout this standard and also common PV faults such as PV array ground faults.

1.1.2 This standard is based on the presupposition that the PV array is installed by qualified persons in accordance with the installation instructions and all applicable installation codes and standards. Evaluation to this standard should not replace other requirements addressing the control of power source(s) for the purposes of worker safety during installation or maintenance. Energized circuits can remain in some PV array equipment after any required hazard control initiation function is operated.

NOTE: Requirements for PV arrays addressed in this standard are intended for compliance with the National Electrical Code (NEC), NFPA 70, 2017 and 2020 editions and their requirements for controlling electrical shock hazards inside the array boundary as addressed in NEC section 690.12(B)(2), Rapid Shutdown of PV Systems on Buildings and with the Canadian Electrical Code (CE Code) C22.1. A PVHCS may or may not additionally comply with the 30V in 30 seconds requirements outside the PV array as required in 690.12 (B)(1).

1.1.3 This standard evaluates the hazards associated with potential exposure to DC currents through defined fire fighter (FF) interactions. Alternating current (AC) exposure is limited to not more than 15 Vac, 8A and 240VA for any circuit within the array boundary.

NOTE: This ac voltage limit is aligned with the PVRS requirements in UL 1741 and general electric shock limits.

1.2 Equipment and conditions included in scope

1.2.1 These requirements relate to conditions where PV array equipment or assemblies are subjected to a safety analysis considering potential fire fighter (FF) interactions while performing duties during an emergency.

NOTE: These conditions may result in degradation or damage from stresses beyond those covered in existing product safety standards.

1.2.2 The acceptable shock hazard risk established by these requirements is based on defined assumptions related to specific personal protective equipment (PPE) in serviceable condition worn by fire fighters (FF) during structural fire fighting operations on buildings.

NOTE: NFPA 1971 Standard on Protective Ensembles for Structural Fire Fighting and Proximity Fire Fighting and NFPA 1851 Standard on Selection, Care, and Maintenance of Protective Ensembles for Structural Fire Fighting and Proximity Fire Fighting specify the selection, care, and maintenance of fire fighter PPE.

1.2.3 Types of fire fighter (FF) tools and extinguishing agents, including certain water plus foam solutions, during specific fire fighter (FF) tasks are considered in this standard.

NOTE: Specifications for these items are outlined in FF PV Array Interactions, Section 12.3.

1.2.4 Body resistances of adult fire fighters (FF) are defined in this standard to set the criteria by which shock hazards are evaluated.

1.2.5 The materials and methods used to construct the PV array are included in the evaluation. The evaluation to this standard is intended to result in an identified list of PV Hazard Control Equipment (PVHCE) determined to be necessary for the PV hazard control means. The list of PVHCE, and any characteristics of other connected equipment or systems that are essential to maintain the operational integrity of the hazard control function are documented in the PVHCE and / or the PV Hazard Control System (PVHCS) installation instructions in accordance with this standard.

1.2.6 The evaluation is based on a risk assessment of the electrical shock hazards to fire fighters (FF) working in the vicinity of the PV array.

1.2.7 The evaluation addresses the electrical hazard potential of PV array equipment on or integrated into buildings.

1.3 Equipment and conditions excluded from scope[1]

1.3.1 The evaluation does not include equipment where the hazard control systems or functions have been rendered ineffective due to physical damage not specifically addressed in this standard. Examples of physical damage not addressed are the direct exposure of components to fire, smoke, high-pressure hose spray, or major systemic physical damage such as building collapse, destruction or removal of the array.

NOTE: See Section 12.3 for the fire fighter (FF) interactions, including handheld hose lines, specifically addressed by this standard. Firefighting Monitors are controllable high capacity water jets that operate at higher pressures and volumes which can result in mechanical or structural damage to equipment and are therefore excluded from the scope of this standard.

[1] Additional installation requirements addressing rapid shutdown of PV system circuits can be found in the National Electrical Code (NEC), NFPA 70, Section 690.12, Rapid Shutdown of PV Systems on Buildings, and the Canadian Electrical Code (CE Code) C22.1 64-218 requirements.

1.3.2 While this standard accounts for fire fighters (FF) wearing new or serviceable used PPE, it does not include consideration for any damage to PPE that occurred prior to fire fighter (FF) interaction with the PV array.

NOTE: Standard operating procedures is to replace damaged fire fighting PPE.

1.3.3 The use of extinguishing agents not specified in this standard, such as seawater or high foam concentrations, are not included in the evaluation.

NOTE: The requirements and resistance data in this standard are based on expected practices and are considered to provide information sufficient for performing a safety analysis.

1.3.4 These requirements do not replace any electrical safe work practices for persons installing, servicing or maintaining the PV system.

1.3.5 Though all components, equipment, and systems that could be used to construct the PV array are considered in the evaluation, not all array equipment and components are required to be identified to perform the PV hazard control function, or be specifically addressed in the installation instructions for the purposes of this standard.

NOTE: Examples for parts that are not required to be identified are parts such as nuts, bolts and other passive components not used directly to provide hazard reduction, as determined by the analysis in Section 12.

1.3.6 These requirements do not address any electrical shock hazards not covered by this standard or other hazards that PV arrays may present such as slip, trip or fall hazards.

1.3.7 This standard is not intended to address fire fighter (FF) interactions involving PV array equipment not installed on a building.

2 Components and Equipment

2.1 A component of a product covered by this standard and systems, including equipment evaluated by this standard, shall comply with the requirements for that component or equipment as specified in this Standard. A component and equipment shall comply with the CSA or UL standards as appropriate for the country where the product is to be installed.

3 Units of Measurement

3.1 Values and their respective units of measurement that are stated without parentheses constitute the requirement of the standard and those in parentheses constitute explanatory or approximate information.

4 Undated References

4.1 Any undated reference appearing in the requirements of this standard shall be interpreted as referring to the latest edition of that standard.

5 Referenced Publications

5.1 The following standards are referenced in this standard, and portions of these referenced standards may be essential for compliance. Some of the standard references are country specific depending upon whether or not the PV system is intended for installation in the Unites States, in Canada, or both.

UL Standards

UL 969 *Marking and Labeling Systems*
UL 1703 *Flat-Plate Photovoltaic Modules and Panels*
UL 1741 *Inverters, Converters, Controllers and Interconnection System Equipment for Use With Distributed Energy Resources*
UL 2703 *Mounting Systems, Mounting Devices, Clamping/Retention Devices, and Ground Lugs for Use with Flat-Plate Photovoltaic Modules and Panels*
UL 4703 *Photovoltaic Wire*
UL 6703 *Connectors for Use in Photovoltaic Systems*
UL 61730-1 *Photovoltaic (PV) Module Safety Qualification – Part 1: Requirements for Construction*
UL 61730-2 *Photovoltaic (PV) Module Safety Qualification – Part 2: Requirements for Testing*
UL 840 *Insulation Coordination Including Clearances and Creepage Distances for Electrical Equipment*
UL 62109-1 *Power Converters for use in Photovoltaic Power Systems – Part 1: General Requirements*
UL 50 *Enclosures for Electrical Equipment, Non-Environmental Considerations*
UL 3003 *Distributed Generation Cables*
UL 1565 *Positioning Devices*
UL 62275 *Cable Management Systems – Cable Ties for Electrical Installations*

CSA Group Standards

C22.1 *Canadian Electrical Code, Part I Safety Standard for Electrical Installations*
C22.2 No. 330 *Photovoltaic Rapid Shutdown Systems*
C22.2 No. 0.15 *Adhesive Labels*