

**STANDARD ON ELECTRIC UTILITY WORKPLACE
ELECTRICAL SAFETY FOR GENERATION, TRANSMISSION,
AND DISTRIBUTION**



ULC Standards
Normes ULC



Standards Council of Canada
Conseil canadien des normes



Documents

Document Sharing Hub

Underwriters Laboratories of Canada (ULC) was established in 1920 by letters patent issued by the Canadian Government. It maintains and operates laboratories and certification services for the examination, testing and certification of appliances, equipment, materials, constructions and systems to determine their relation to life, fire and property hazards as well providing inspection services.

Underwriters Laboratories of Canada is accredited by the Standards Council of Canada as a Certification Organization, a Testing Organization, and an Inspection Body under the National Standards System of Canada.

ULC Standards develops and publishes standards and other related publications for building construction, security and burglar protection, environmental safety, electrical equipment, fire protection equipment, gas and oil equipment, thermal insulation products, materials and systems, energy use in the built environment and electrical utility safety.

ULC Standards is a not-for-profit organization and is accredited by the Standards Council of Canada as a Standards Development Organization.

National Standards of Canada developed by ULC Standards conform to the criteria and procedures established by the Standards Council of Canada. Such standards are prepared using the consensus principle by individuals who provide a balanced representation of interests relevant to the subject area on a national basis.

ULC is represented across Canada as well as many countries worldwide. For further information on ULC services, please contact:

Customer Service: 1-866-937-3852

CORPORATE HEADQUARTERS

Underwriters Laboratories of Canada
7 Underwriters Road
Toronto, Ontario M1R 3A9
Telephone: (416) 757-3611
Fax: (416) 757-9540

REGIONAL OFFICES

PACIFIC OFFICE

13775 Commerce Parkway, Suite 130
Richmond, British Columbia V6V 2V4
Telephone: (604) 214-9555
Fax: (604) 214-9550

EASTERN OFFICE

6505, Rte Transcanadienne, Suite 330
St-Laurent, Québec H4T 1S3
Telephone: (514) 363-5941
Fax: (514) 363-7014

ULC STANDARDS

171 Nepean Street, Suite 400
Ottawa, Ontario K2P 0B4
Telephone: (613) 755-2729
Fax: (613) 231-5977

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.

Copies of this National Standard of Canada may be ordered from ULC Standards.

The Standards Council of Canada (SCC) is the coordinating body of the Canadian standardization network, which is composed of people and organizations involved in the development, promotion and implementation of standards. Through the collaborative efforts of Canadian standardization network members, standardization is helping to advance the social and economic well-being of Canada and to safeguard the health and safety of Canadians. The network's efforts are overseen by SCC.

The principal objectives of SCC are to foster and promote voluntary standardization as a means of advancing the national economy, supporting sustainable development, benefiting the health, safety and welfare of workers and the public, assisting and protecting the consumer, facilitating domestic and international trade, and furthering international cooperation in relation to standardization.

An important facet of the Canadian standards development system is the use of the following principles: consensus; equal access and effective participation by concerned interests; respect for diverse interests and identification of those who should be afforded access to provide the needed balance of interests; mechanism for dispute resolution; openness and transparency; open access by interested parties to the procedures guiding the standards development process; clarity with respect to the processes; and Canadian interest consideration as the initial basis for the development of standards.

A National Standard of Canada (NSC) is a standard prepared or reviewed by an SCC-accredited SDO and approved by the SCC according to NSC approval requirements. Approval does not refer to the technical content of the standard, as this remains the responsibility of the SDO. An NSC reflects a consensus of a number of capable individuals whose collective interests provide, to the greatest practicable extent, a balance of representation of general interests, producers, regulators, users (including consumers) and others with relevant interests, as may be appropriate to the subject at hand. NSCs are intended to make a significant and timely contribution to the Canadian interest.

Those who have a need to apply standards are encouraged to use NSCs. These standards are subject to periodic review. Users of NSCs are cautioned to obtain the latest edition from the SDO that publishes the standard.

The responsibility for approving standards as NSCs rests with:

Standards Council of Canada
270 Albert Street
Suite 200
Ottawa, Ontario
K1P 6N7
Telephone: (613) 238-3222

E-mail: customerservice@ulc.ca
Web site: www.ulc.ca

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

STANDARD ON ELECTRIC UTILITY WORKPLACE ELECTRICAL
SAFETY FOR GENERATION, TRANSMISSION, AND DISTRIBUTION

ICS 13.100; 13.260

Prepared and Published by



Approved by



First Edition. January 2010
SECOND EDITION. DECEMBER 2014

Copyright © 2014

ULC STANDARDS

All rights reserved. No part of this publication may be reproduced in any form, in an electronic retrieval system or otherwise, without prior permission.

AVAAVAVAVAVAVAVAVAVAVA

TABLE OF CONTENTS

ULC STANDARDS COMMITTEE ON ELECTRIC UTILITY WORKPLACE ELECTRICAL SAFETY	I
PREFACE	II
1. SCOPE	1
2. REFERENCE PUBLICATIONS	1
3. GLOSSARY	8
4. FUNDAMENTAL REQUIREMENTS	20
4.1 ROLES & RESPONSIBILITIES	20
4.1.1 Employers	20
4.1.1.1 Protection for Workers	20
4.1.1.2 Safety Training	21
4.1.1.3 Equipment	21
4.1.1.4 Monitoring	21
4.1.1.5 Worker in Charge	21
4.1.1.6 Visitors	22
4.1.2 Workers	22
4.1.2.1 Rules Governing Workplace Safety*	22
4.1.2.2 Safe Work Practices	22
4.1.2.3 Tools, Devices and Equipment	23
4.1.2.4 Report Unsafe Practices and Defective Equipment	23
4.1.2.5 Number of Workers Required	23
4.2 WORKER QUALIFICATIONS	23
4.2.1 General	23
4.2.2 Qualification of Workers	24
4.2.3 Authorization Requirements	24
4.2.4 Special Qualification and Authorization	24
4.2.5 Unqualified Workers	24
4.3 IDENTIFICATION AND LOCATION	24
4.3.1 Fundamental Requirements	24
4.3.2 Identification Requirements	25
4.3.3 Electric Utility System Status*	25
4.4 WORK PLANNING	25
4.4.1 Fundamental Requirements	25
4.4.2 Project Safety Planning	25
4.4.3 Safe Work Planning	26
4.4.4 Hazard Identification, Elimination, Risk Assessment & Control	26
4.4.4.1 Employer's Responsibility	26
4.4.4.2 Worker's Responsibility	26
4.4.5 Approach to Elimination and Control	26
4.4.6 Record Keeping	27
4.4.7 Emergency Response to an Uncontrolled Hazard	27
4.5 PERSONAL PROTECTIVE EQUIPMENT (PPE)	27
4.5.1 General PPE	27
4.5.2 Head Protection	27
4.5.3 Eye and Face Protection	27

4.5.4	Hearing Protection	28
4.5.5	Skin (Body) Protection	28
4.5.6	Foot Protection	29
4.5.7	Hand Protection	29
4.5.8	Fall Protection	29
4.6	EMERGENCY RESPONSE AND FIRST AID	31
4.6.1	Emergency Response Plan	31
4.6.2	Contents of Plan	31
4.6.3	Emergency Response	31
4.6.4	Rescue and Evacuation Workers & Rescue Training	31
4.6.5	Equipment	32
4.6.6	First Aid	32
4.6.7	Fire Protection	32
5.	MINIMUM APPROACH DISTANCES FOR WORKING NEAR OR ON ENERGIZED ELECTRICAL LINES OR EQUIPMENT	32
5.1	FUNDAMENTAL REQUIREMENTS	32
5.1.1	GENERAL	32
5.1.2	ERGONOMIC DISTANCE	32
6.	PROTECTIVE TOOLS, EQUIPMENT & DEVICES	34
6.1	FUNDAMENTAL REQUIREMENTS	34
6.2	TYPES OF TOOLS, EQUIPMENT AND DEVICES	35
6.2.1	Electrical Insulating Protective Equipment	35
6.2.2	Flexible Protective Covers	35
6.2.3	Rigid Protective Covers	35
6.2.4	Tools for Live Working	35
6.2.5	Temporary Grounds and Bonds	37
6.2.6	Portable Bond Mats	37
6.2.7	Ground Fault Circuit Interrupters	37
6.2.8	Protective Equipment Certification and Periodic Testing	37
6.2.9	Conductive Protective Equipment	37
6.2.10	Insulating Aerial Devices	37
6.2.11	Diagnostic Devices	38
6.2.11.1	Voltage Detectors	38
6.2.11.2	Phase Comparators (Phasing Testers)	38
6.2.11.3	Phase Sequence Tester	38
6.2.12	Measuring Devices	39
6.2.12.1	Safety Requirements	39
6.2.12.2	Current Meters	39
6.2.12.3	Volt Meters	39
6.2.12.4	Multimeters	39
6.2.12.5	Ground Resistance Tester	39
6.2.13	Manufacturer and Utility Compliance	40
7.	WORKING ON ENERGIZED ELECTRICAL LINES AND EQUIPMENT	40
7.1	FUNDAMENTAL REQUIREMENTS	40
7.1.1	General	40
7.1.2	High Voltage (HV) Live Work Program	40
7.2	LIVE WORK FUNDAMENTAL PRINCIPLES	41

7.3	TRAINING	42
7.4	INSULATING MATERIALS USED IN LIVE WORKING	42
7.4.1	General	42
7.4.2	Cover-Up Equipment	43
7.4.3	Live Work Tools	43
7.5	WORKING WITH MINIMUM APPROACH DISTANCES	44
7.5.1	General	44
7.6	RULES FOR WORKING ON INSULATOR ASSEMBLIES OPERATING ABOVE 72.5 kV a.c. L-L*	44
7.7	IDENTIFICATION AND LOCATION OF ELECTRICAL LINES AND EQUIPMENT	45
7.8	CATEGORIES OF ENERGIZED LINE WORK**	45
7.8.1	Ground Potential	45
7.8.2	Intermediate Potential	45
7.8.3	Line Potential	45
7.9	WORKSITE PROTECTION	46
7.9.1	Workers on the Ground	46
7.9.2	Stringing Conductors	46
7.9.3	Installation and Maintenance of Optical Cables	46
7.10	LINE POTENTIAL (I.E. BARE HAND WORK)**	46
7.10.1	Mitigation of Electric Field Effects on Workers	46
7.10.2	Bonding	46
7.11	HIGH VOLTAGE (HV) DIRECT CURRENT	47
7.12	LOW VOLTAGE (LV) LIVE WORKING	47
7.12.1	General	47
7.12.2	Voltage up to 300 V a.c. L-L	47
7.12.3	Voltage Greater than 300 V a.c. L-L	48
7.13	REVENUE METERING	48
7.13.1	General	48
7.13.2	Self Contained Meter Units	48
7.13.3	Transformer Rated Metering	48
7.13.4	Three Phase Metering	48
7.14	BATTERY BANKS, CHARGERS, UNINTERRUPTIBLE POWER SYSTEMS	48
7.15	UNDERGROUND ELECTRIC UTILITY SYSTEMS	49
7.15.1	Fundamental Requirements	49
7.15.2	Working with Underground Cables and Equipment	49
7.15.3	Installing Cables	50
7.15.4	Cable Testing and Fault Location	51
7.15.5	Switching Operations	51
7.15.6	Exposing Underground Cables	51
7.15.7	Ferro-resonance in Underground	53
8.	ELECTRIC ARC HAZARD PROTECTION	54
8.1	FUNDAMENTAL REQUIREMENTS	54
8.2	ARC FLASH RISK ASSESSMENTS	54
8.3	ENGINEERING AND CONTROL	55
8.4	ARC-RATED PERSONAL PROTECTIVE EQUIPMENT (PPE)	56
8.5	CARE AND MAINTENANCE OF ARC-RATED CLOTHING AND OTHER PPE	57
9.	RADIO FREQUENCY HAZARDS	57
9.1	FUNDAMENTAL REQUIREMENTS	57

10. WORKING ON ISOLATED ELECTRIC UTILITY SYSTEMS	58
10.1 FUNDAMENTAL REQUIREMENTS	58
10.2 ISOLATING AND GROUNDING/BLOCKING OF ELECTRIC UTILITY SYSTEMS ...	58
10.3 HAZARDOUS ENERGY CONTROL IN THE ELECTRIC UTILITY INDUSTRY	59
10.3.1 Fundamental Requirements	59
10.3.2 Lockout and Tagging	59
10.4 PROTECTIVE EQUIPOTENTIAL BONDING AND GROUNDING	60
10.4.1 Fundamental Requirements	60
10.4.2 Equipotential Bonding and Grounding (EBG) at the Worksite	61
11. WORKING NEAR ELECTRIC UTILITY SYSTEMS	63
11.1 FUNDAMENTAL REQUIREMENTS	63
11.2 NON-UTILITY WORKERS AND OTHER PERSONS WORKING ON JOINT USE STRUCTURES OR NEAR ELECTRICAL LINES AND EQUIPMENT	64
11.2.1 General	64
11.2.2 Approach to Energized Conductors or Parts	64
11.2.3 Joint Use Structures	64
11.2.4 Access to Subsurface Chambers by Non-Utility Workers	65
11.3 VEGETATION MANAGEMENT NEAR ELECTRICAL LINES AND EQUIPMENT ...	65
11.3.1 Vegetation Management Plan	65
11.3.2 Worker Requirements (Qualifications)	65
11.3.3 Protective Requirements	65
11.3.4 Use of Insulating Devices	65
11.4 GENERATION SYSTEMS	65
11.4.1 Electrical Rotating Machines	65
11.4.1.1 Inductive Circuits	65
11.4.1.2 Generator Isolating, Bonding and Grounding	65
11.4.1.3 Adverse Impact on Rubber Insulating Tools and Equipment	66
11.4.1.4 Isolated Phase Bus	66
11.4.1.5 High Current, Single Phase Cables	66
APPENDIX A – SAFE WORK PLAN HAZARD ASSESSMENT AND EMERGENCY RESPONSE PLAN FORM & PROJECT PLANNING HAZARD ASSESSMENT FORM (INFORMATIVE)	67
APPENDIX B – MINIMUM APPROACH DISTANCE (INFORMATIVE)	70
APPENDIX C – ARC FLASH CALCULATIONS (INFORMATIVE)	91
APPENDIX D – EQUIPOTENTIAL BONDING & GROUNDING (EBG) FOR OVERHEAD TRANSMISSION AND DISTRIBUTION FACILITIES (INFORMATIVE)	99
APPENDIX E – DESCRIPTION AND USE OF THE STANDARDS RELATED TO THE PRODUCTS USED AS PPE INCLUDING CLOTHING (INFORMATIVE)	117
APPENDIX F – FALL PROTECTION SYSTEMS (INFORMATIVE)	119

APPENDIX G – LIST OF ACRONYMS (INFORMATIVE) 125

BIBLIOGRAPHY 126

.....

ULC STANDARDS COMMITTEE ON ELECTRIC UTILITY WORKPLACE ELECTRICAL SAFETY

NAME	AFFILIATION	REGION	CATEGORY
K. Switzer (Chair)	Switzer Management Consulting	British Columbia	General Interest
E. Chopee	Hydro One Networks	Ontario	User
R. Cislo	EPCOR Utilities Inc.	Alberta	Producer
T. Corbett	SaskPower	Saskatchewan	User
J.F. Desmarais	Commission de la santé et de la sécurité du travail (CSST)	Québec	Regulator
P. Falzon	Electrical Safety Authority (ESA)	Ontario	Regulator
R. Farmer	Salisbury by Honeywell	Canada	Producer
G. Gela	Electric Power Research Institute	U.S.A	General Interest
C. Grandy	AGO Industries Inc.	Ontario	Producer
C. Holowaychuk	Acklands Grainger Inc.	British Columbia	Producer
H. Krizou	Hydro-Quebec Distribution	Québec	User
S. Levin	True North Gear/ Dragonwear	Canada	Producer
J. McDonald	Powerline	Canada	General Interest
J. McFadgen	Nova Scotia Power Inc.	Nova Scotia	User
B. Murray	Fortis Alberta Inc.	Alberta	User
J. Newell	B.C. Hydro	British Columbia	User
T. Nicholls	The Power Workers' Union	Ontario	General Interest
V. Oganezov	ABB	Canada	Producer
J. Pollard	Oberon	Canada	Producer
K. Robertson	MWG Apparel Corporation	Manitoba	Producer
U. Sheraz	Government of Alberta	Alberta	Regulator
H. Werden	ATCO Electric	Alberta	User
M. Wilkinson	Ontario Power Generation	Ontario	User
M. Velie	International Brotherhood of Electrical Workers (IBEW)	Manitoba	General Interest
C. Comte (Associate Member)	IREQ, Hydro-Québec	Québec	Non-voting
B. Gibson (Associate Member)	MWG Apparel Corporation	Manitoba	Non-voting
K. Locke (Associate Member)	Fortis Alberta Inc.	Alberta	Non-voting
W.C. Murphy (Associate Member)	AGO Industries Inc.	Ontario	Non-voting
W. van Halderen (Associate Member)	Canadian Electricity Association (CEA)	Canada	Non-voting
G. Ottley (Project Manager)	ULC Standards	Canada	Non-voting

This list represents the membership at the time the Committee balloted on the final text of this edition. Since that time, changes in the membership may have occurred.

STANDARD ON ELECTRIC UTILITY WORKPLACE ELECTRICAL SAFETY FOR GENERATION, TRANSMISSION AND DISTRIBUTION

PREFACE

This is the Second Edition of CAN/ULC-S801-14, Standard on Electric Utility Workplace Electrical Safety for Generation, Transmission and Distribution.

This Edition of the Standard has been formally approved by the ULC Standards Committee on Electric Utility Workplace Electrical Safety and has been approved as a National Standard of Canada by the Standards Council of Canada.

Subsections of this Standard that are based on IEEE C2-2012, National Electrical Safety Code, IEEE 516-2003, or IEEE 516-2009, IEEE Guide for Maintenance Methods on Energized Power Lines, are indicated by footnotes and are reprinted with permission from IEEE, 3 Park Avenue, New York, NY 10016-5997 USA, Copyright 2012, 2003 and 2009, respectively, by IEEE.

Only metric SI units of measurement are used in this Standard. If a value for measurement is followed by a value in other units in parentheses, the second value may be approximate. The first stated value is the requirement.

Voltages stated in this standard are Root Mean Square (RMS) voltage difference from ground potential, unless otherwise specified.

Appendices A through G, identified as informative, are for information purposes only.

This Second Edition National Standard of Canada is based on, and now supersedes, the First Edition.

Attention is drawn to the possibility that some of the elements of this Canadian standard may be the subject of patents rights. ULC Standards shall not be held responsible for identifying any or all such patents rights.

Requests for interpretation of this Standard should be sent to ULC Standards. The requests should be worded in such a manner as to permit a “yes” or “no” answer based on the literal text of the requirement concerned.

The initiation of the review of this Standard will commence within 5 years of the date of publication, unless the Standard is identified as fitting within a stabilized category, whereby the review will commence within the appropriate time frame set out by ULC Standards.

ULC Standards acknowledges the generous funding support of the Canadian Electricity Association (CEA) in the development of this Standard.

1. SCOPE

1.1 This Standard applies to the construction, operation, maintenance and replacement of electric utility systems that are used to generate, transform, transmit, distribute or deliver electrical power or energy to consumer services or their equivalent, including:

- A Equipment located in easements, rights of way, or in other recognized agreements;
- B Equipment located on property owned or leased by the electric utility for the purpose of communication, metering and control of electrical power or energy;
- C Service drops or laterals, associated metering, and street lighting under the exclusive control of electric utilities;
- D Facilities used to generate electrical power or energy for electric utility systems; and
- E Voltage levels up to 800 kV a.c. line-to-line (L-L) and 600 kV d.c.

1.2 The purpose of this Standard is to provide safety performance requirements for electric utilities, workers and employers involved in work on or *near* electric generation, transmission and distribution systems.

1.3 If a difference of interpretation arises with respect to the application of this Standard, the decision of the employer or the employer's representative shall be final. This decision shall not result in any worker performing work in a manner that is hazardous to the worker, fellow workers or the public.

2. REFERENCE PUBLICATIONS

2.1 The documents listed below are referenced in the text of this Standard. Background referenced material is listed in the bibliography of this Standard. Unless otherwise stated elsewhere in this Standard such reference shall be considered to indicate the edition and/or revisions of the document available at the date on which the Committee approved this ULC Standard.

Document Published by the American Society of Safety Engineers (ASSE)
1800 E Oakton Street, Des Plaines, IL, 60018
Telephone: (847) 699-2929
www.asse.org

- ANSI/ASSE A10.31-13, Safety Requirements, Definitions and Specifications for Digger Derricks

Documents Published by the American Society for Testing and Materials (ASTM)
100 Barr Harbour Drive, PO Box C700, West Conshohocken, PA 19428-2959 U.S.A.
Telephone: (610) 832-9585
www.astm.org

- ASTM B33-10, Standard Specification for Tin-Coated Soft or Annealed Copper Wire for Electrical Purposes
- ASTM D178-01 (R 2010), Standard Specification for Rubber Insulating Matting

Copyright Underwriters' Laboratories of Canada

- ASTM D1049-98 (R 2010), Standard Specification for Rubber Insulating Covers
- ASTM D2865M-06, Standard Practice for Calibration of Standards and Equipment for Electrical Insulating Materials Testing
- ASTM F855-09, Standard Specifications for Temporary Protective Grounds to be Used on De-energized Electric Power Line and Equipment
- ASTM F887-13, Standard Specifications for Personal Climbing Equipment
- ASTM F1117-03 (R 2013), Standard Specification for Dielectric Footwear
- ASTM F1506-10a, Standard Performance Specification for Flame Resistant and Arc Rated Textile Materials for Wearing Apparel for Use by Electrical Workers Exposed to Momentary Electric Arc and Related Thermal Hazards
- ASTM F1701-12, Standard Specification for Unused Rope with Special Electrical Properties
- ASTM F1891-12, Standard Specification for Arc and Flame Resistant Rainwear
- ASTM F1959/F1959M-14, Standard Test Method for Determining the Arc Rating of Materials for Clothing
- ASTM F2178-12, Standard Test Method for Determining the Arc Rating and Standard Specification for Eye or Face Protective Products
- ASTM F2249-03 (R 2009), Standard Specification for In-Service Test Methods for Temporary Grounding Jumper Assemblies Used on De-energized Electric Power Lines and Equipment
- ASTM F2321-05 (R 2013), Standard Specification for Flexible Insulated Temporary By-Pass Jumpers
- ASTM F2621-12, Standard Practice for Determining Response Characteristics and Design Integrity of Arc Rated Finished Products in an Electric Arc Exposure
- ASTM F2675/F2675M-13, Standard Test Method for Determining Arc Ratings of Hand Protective Products Developed and Used for Electrical Arc Flash Protection
- ASTM F2676-09, Standard Test Method for Determining Protective Performance of an Arc Protective Blanket for Electric Arc Hazards
- ASTM F2715-09, Standard Specification for Temporary Protective Equipotential Bond Mat to be Used on De-Energized Equipment

Document Published by the Canadian General Standards Board (CGSB)

Place du Portage III, 6B1

11 Laurier Street

Gatineau, Quebec K1A 1G6

Telephone: (819) 956-0425

Email: ncr.cgsb-ongc@tpsgc-pwgsc.gc.ca

<http://www.tpsgc-pwgsc.gc.ca>

- CAN/CGSB-155.20-2000, Workwear for Protection Against Hydrocarbon Flash Fire
-

Documents Published by the Canadian Standards Association (CSA)
5060 Spectrum Way, Mississauga, ON L4W 5N6 Canada
Telephone: (416) 747-4000 or 1-800-469-6727
www.csa.ca

- CAN/CSA-C22.2 No. 61010-1-12, Safety Requirements for Electrical Equipment for Measurement, Control and Laboratory Use - Part 1: General Requirements
- CAN/CSA-C22.2 No. 61010-031-07 AMD1, Safety Requirements for Electrical Equipment for Measurement, Control and Laboratory Use - Part 031: Safety Requirements for Hand-Held Probe Assemblies for Electrical Measurement and Test
- CAN/CSA-C22.2 No. 61010-2-032-04 (R 2009), Safety Requirements for Electrical Equipment for Measurement, Control and Laboratory Use - Part 2-032: Particular Requirements for Hand-Held and Hand-Manipulated Current Sensors for Electrical Test and Measurement
- CAN/CSA-C22.3 No. 1-10, Overhead Systems
- CAN/CSA-C22.3 No. 7-10, Underground Systems
- CAN/CSA-C225-10, Vehicle-Mounted Aerial Devices
- CSA CAN3-C235-83 (R 2010), Preferred Voltage Levels for AC Systems, 0 to 50 000 V
- CAN/CSA-Z94.1-05 (R 2013), Industrial Protective Headwear – Performance, Selection, Care and Use
- CAN/CSA-Z94.2-02 (R 2011), Hearing Protection Devices – Performance, Selection, Care and Use
- CSA-Z94.3-07 (R 2012), Eye and Face Protectors
- CSA-Z94.3.1-09, Selection, Use and Care of Protective Eyewear
- CAN/CSA-Z96-09, High-Visibility Safety Apparel
- CAN/CSA-Z150-11 , Safety Code on Mobile Cranes
- CSA-Z195-09, Protective Footwear
- CSA-Z259.1-05 (R 2010), Body Belts and Saddles for Work Positioning and Travel Restraint
- CAN/CSA-Z259.2.1-98 (R 2011), Fall Arresters, Vertical Lifelines and Rails
- CSA-Z259.2.2-14 , Self-Retracting Devices
- CAN/CSA-Z259.2.3-12 , Descent Devices
- CAN/CSA-Z259.10-12, Full Body Harnesses
- CSA-Z259.11-05 (R 2010), Energy Absorbers and Lanyards
- CAN/CSA-Z259.12-01 (R 2011), Connecting Components for Personal Fall Arrest Systems (PFAS)
- CAN/CSA-Z259.13-04 (R 2009), Flexible Horizontal Lifeline System

- CAN/CSA-Z259.14-12, Fall Restrict Equipment for Wood Pole Climbing
- CAN/CSA-Z259.15-12, Anchorage Connectors
- CAN/CSA-Z259.16-04 (R 2009), Design of Active Fall-Protection Systems
- CAN/CSA-Z460-05 (R 2010), Control of Hazardous Energy Lockout and Other Methods
- CSA-Z1002-12, Occupational Health and Safety - Hazard Identification and Elimination and Risk Assessment and Control

Document Published by the Electrical Safety Authority
155 Matheson Boulevard West, Mississauga, Ontario L5R 3L5
Telephone: 1 877 372-7233
www.easafe.com

- Guideline for Excavation in the Vicinity of Utility Lines-1.0, 2008

Document Published by Health Canada
The Consumer and Clinical Radiation Protection Bureau
775 Brookfield Road, Ottawa, Ontario K1A 1C1
Telephone: (613) 954-6699
Email: CCRPB-PCRPPC@hc-sc.gc.ca
www.hc-sc.gc.ca

- Limits of Human Exposure to Radiofrequency Electromagnetic Fields in the Frequency Range from 3 kHz to 300 GHz – Safety Code 6, 2009

Document Published by the International Council on Large Electric Systems (CIGRE)
CIGRE Central Office, 21 rue d'Artois, Paris, France F75008
Telephone: +33 (0) 1 53 89 12 90
www.cigre.org

- CIGRE 151-2000, Guidelines for Insulation Coordination in Live Working

Documents Published by the International Electrotechnical Commission (IEC)
IEC Central Office, 3 rue de Varembe, P.O. Box 131, CH - 1211 GENEVA 20, Switzerland
Telephone: +41 22 919 02 11
E-mail: info@iec.ch
www.iec.ch

- IEC 60050:2014, International Electrotechnical Vocabulary (IEV)
- IEC 60079-14:2013, Explosive atmospheres - Part 14: Electrical installations design, selection and erection
- IEC 60092-101:2002, Electrical installations in ships - Part 101: Definitions and general requirements
- IEC TS 60479-1:2005, Effects of current on human beings and livestock – Part 1: General aspects

- IEC 60947-1:2011, Low-voltage switchgear and controlgear - Part 1: General rules
- IEC 61010-2-032:2012, Safety requirements for electrical equipment for measurement, control, and laboratory use – Part 2-032: Particular requirements for hand-held and hand-manipulated current sensors for electrical test and measurement
- IEC 61010-2-033:2012, Safety requirements for electrical equipment for measurement, control, and laboratory use – Part 2-033: Particular requirements for hand-held multimeters and other meters for domestic and professional use, capable of measuring mains voltage
- IEC 61111:2009, Live working – Electrical insulating matting
- IEC 61158-2:2010, Industrial communication networks - Fieldbus specifications - Part 2: Physical layer specification and service definition
- IEC/TR 61243-6, Live working – Voltage detectors – Part 6: Guidelines on non-contact voltage detectors (NCVD) for use at nominal voltages above 1 kV a.c.
- IEC 61557-4:2007, Electrical safety in low voltage distribution systems up to 1 000 V a.c. and 1 500 V d.c. – Equipment for testing, measuring or monitoring of protective measures – Part 4: Resistance of earth connection and equipotential bonding
- IEC 61557-5:2007, Electrical safety in low voltage distribution systems up to 1 000 V a.c. and 1 500 V d.c. – Equipment for testing, measuring or monitoring of protective measures – Part 5: Resistance of earth
- IEC 61557-7:2007, Electrical safety in low voltage distribution systems up to 1 000 V a.c. and 1 500 V d.c. – Equipment for testing, measuring or monitoring of protective measures – Part 7: Phase sequence
- IEC 61821:2011, Electrical installations for lighting and beaconing of aerodromes - Maintenance of aeronautical ground lighting constant current series circuits
- IEC 61892-2:2011, Mobile and fixed offshore units - Electrical installations - Part 2: System Design
- IEC 61968-2:2011, Application integration at electric utilities - System interfaces for distribution management – Part 2: Glossary
- IEC 62128-1:2013, Railway applications - Fixed installations – Electrical Safety, Earthing and the Return Circuit - Part 1: Protective provisions against electric shock
- IEC TR 62263:2005, Live working – Guidelines for the installation and maintenance of optical fibre cables on overhead power lines

Documents Published by the Institute of Electrical and Electronic Engineers (IEEE)
Three Park Avenue, New York NY 10016-5990 U.S.A.
Telephone: 800-843-2763
www.ieee.org

- IEEE C2-2012, National Electrical Safety Code
- IEEE C37.100-1992 (R 2001), Standard Definitions for Power Switchgear
- IEEE 516-2003 and 2009, Guide for Maintenance Methods on Energized Power Lines

- IEEE 1048-2003, Guide for Protective Grounding of Power Lines
- IEEE 1584-2002, Guide for Performing Arc Flash Hazard Calculations
- IEEE 1654-2009, RF Protection of Personnel Working in the Vicinity of Wireless Communications Antennas Attached to Electric Power Line Structures

Document Published by the International Organization for Standardization (ISO)
ISO Central Secretariat, 1, ch, de la Voie-Creuse, CP 56, CH-1211 Geneva 20, Switzerland
Telephone: +41 22 749 01 11
Email: central@iso.org
www.iso.org

- ISO 472: 2013, Plastics – Vocabulary
- ISO/IEC 17000:2004, Conformity Assessment – Vocabulary and general principles
- ISO/IEC 17025:2005, General Requirements for the Competence of Testing and Calibration Laboratories
- ISO/IEC Guide 51: 2014, Safety aspects – Guidelines for their inclusion in standards

Document Published by the National Electrical Manufacturers Association
1300 North 17th Street, Suite 1752, Rosslyn, Virginia 22209
Telephone: (703) 841-3200
www.nema.org

- ANSI/NEMA C29.2 B-2013, Insulators – Wet-Process Porcelain and Toughened Glass – Transmission Suspension Type

Documents Published by the National Fire Protection Agency
1 Batterymarch Park
Quincy, Massachusetts, USA 02169-7471
Telephone: (617) 770-3000
www.nfpa.org

- NFPA 70E-2012, Standard for Electrical Safety in the Workplace
- NFPA 2112-2012, Standard on Flame Resistant Garments for the Protection of Industrial Personnel Against Flash Fire

Document Published by SaskPower
2025 Victoria Avenue, Regina, Saskatchewan S4P 0S1 Canada
Telephone: (306) 566-2121
www.saskpower.com

- SaskPower TS&R Report Number 05-345, Arc Protection Recommendations for SaskPower Transmission and Distribution, 2005

Documents Published by Underwriters Laboratories of Canada (ULC)

7 Underwriters Road, Toronto, ON M1R 3B4 Canada

Telephone: (416) 757-3611 or 1-866-9373-ULC

www.ulc.ca

- CAN/ULC-60855-09, Live Working – Insulating Foam-Filled Tubes and Solid Rods for Live Working (IEC 60855:1985, MOD)
- CAN/ULC-60895-09, Live Working – Conductive Clothing for Use at a Nominal Voltage up to 800 kV a.c. and ± 600 kV d.c. (IEC 60895:2002, MOD)
- CAN/ULC-60903-09, Live Working – Gloves of Insulating Material (IEC 60903:2002, MOD)
- CAN/ULC-60984-08, Sleeves of Insulating Material for Live Working (IEC 60984:2002, MOD)
- CAN/ULC-61112-09, Live Working – Blankets of Insulating Material for Electrical Purposes (IEC 61112:1992, MOD)
- CAN/ULC-61229-09, Rigid Protective Covers for Live Working on a.c. Installations (IEC 61229:2002, MOD)
- CAN/ULC-61230-09, Live Working – Portable Equipment for Grounding and Bonding (IEC 61230:2008, IDT)
- CAN/ULC-61235-09, Live Working – Insulating Hollow Tubes for Electrical Purposes (IEC 61235:1993, IDT)
- CAN/ULC-61243-2-09, Live Working – Voltage Detectors – Part 2: Resistive Type to be Used for Voltages of 1 kV to 36 kV a.c. (IEC 61243-2:2002, MOD)
- CAN/ULC-61328-09, Live Working – Guidelines for the Installation of Transmission Line Conductors and Earthwires – Stringing Equipment and Accessory Items (IEC TR 61328:2003, MOD)
- CAN/ULC-61478-05, Live Working – Ladders of Insulating Material (IEC 61478:2003, IDT)
- CAN/ULC-61479-05, Live Working – Flexible Conductor Covers (Line Hoses) of Insulating Material (IEC 61479:2002, IDT)
- CAN/ULC-D61481-06, Live Working – Portable Phase Comparators for Use on Voltages from 1 kV to 36 kV a.c. (IEC 61481-A2:2004, MOD)
- CAN/ULC-61482-1-1-09, Live Working – Protective Clothing against the Thermal Hazards of an Electric Arc - Part 1–1: Test Methods-Method 1: Determination of the Arc Rating (ATPV or E_{BT50}) of flame resistant materials for clothing (IEC 61482-1-1:2009, IDT)
- CAN/ULC-61482-2-09, Live Working – Protective Clothing against the Thermal Hazards of an Electric Arc - Part 2: Requirements (IEC 61482-2:2009, MOD)
- CAN/ULC-61911-05, Live Working – Guidelines for the Installation of Distribution Line Conductors – Stringing Equipment and Accessory Items (IEC TR 61911:2003, IDT)
- CAN/ULC-62192-09, Live Working – Insulating Ropes (IEC 62192:2009, MOD)

- CAN/ULC-62193-09, Live Working – Telescopic Sticks and Telescopic Measuring Sticks (IEC 62193:2003, MOD)
- CAN/ULC-62237-09, Live Working – Insulating Hoses with Fittings for Use with Hydraulic Tools and Equipment (IEC 62237:2003, MOD)

Documents Published by ULC Standards

171 Nepean Street, Suite 400, Ottawa, ON K2P 0B4 Canada

Telephone: (416) 757-3611, ext. 61744; Fax (613) 231-5977, "ATTN: Publications"

E-mail: publications@ulc.ca

www.ulc.ca

- CAN/ULC-S508-02 (R 2013), Standard for Rating and Fire Testing of Fire Extinguishers
- CAN/ULC-60743-14, Live Working – Terminology for Tools, Devices and Equipment (IEC 60743:2013, IDT)
- CAN/ULC-60832-1-10, Live Working - Insulating Sticks and Attachable Devices-Part 1: Insulating Sticks (IEC 60832–1:2010, MOD)
- CAN/ULC-60832-2-10, Live Working- Insulating Sticks and Attachable Devices-Part 2: Attachable Devices (IEC 60832–2:2010, MOD)
- CAN/ULC-60900-14, Live Working – Hand Tools for use up to 1 000 V a.c. and 1 500 V d. c. (IEC 60900:2012, MOD)
- CAN/ULC-61236-14, Live Working – Saddles, Stick Clamps and their Accessories (IEC 61236:2010, MOD)
- CAN/ULC-61243-1-10, Live Working – Voltage Detectors – Part 1: Capacitive Type to be Used for Voltage Exceeding 1 kV a.c. (IEC 61243-1:2009, MOD)
- CAN/ULC-61243-3-10, Live Working – Voltage Detectors – Part 3: Two-Pole Low-Voltage Type (IEC 61243-3:2009, MOD)
- CAN/ULC-61472-14, Live Working – Minimum Approach Distances for A.C. Systems in the Voltage Range 72,5 Kv to 800 Kv – A Method of Calculation (IEC 61472:2013, IDT)
- CAN/ULC-61477-11, Live Working – Minimum Requirements for the Utilization of Tools, Devices and Equipment (IEC 61477:2009, MOD)

3. GLOSSARY

NOTE: A term may have multiple definitions. The applicable definition depends upon the context in which the term is used.

Terms used in this Standard that are in *italic* print are defined as follows:

3.1 **ACCESSIBLE** –

1. An object or device that can be inadvertently touched or approached nearer than a safe distance by any person; applies to objects not suitably *guarded* or *insulated*. [Definition of IEC 60092-101, modified]
2. An area to which, under normal operating conditions, one of the following applies:
 - i. Access can be gained without the use of a tool;
 - ii. The means of access is deliberately provided to the operator;
 - iii. The operator is *instructed* to enter regardless of whether or not a tool is needed to gain access.

NOTE: The terms "access" and *accessible*, unless qualified, relate to an operator access area as defined above. [Definition of IEC 62282-3-1, modified]

3.2 AERIAL DEVICE – Any device, extensible, articulating, or both, that is primarily designed and used to position personnel. The device may also be used to handle material, if designed and equipped for that purpose. [Definition of CAN/CSA-C225]

3.3 ALIVE – see *ENERGIZED*.

3.4 APPROVAL – Confirmation by an authority of conformance to defined requirements.

3.5 ARBOURIST – A worker that specializes in the control, modification and removal of vegetation; a prerequisite qualification to becoming a *Utility Arbourist*.

3.6 ARC FLASH HAZARD – see *ELECTRIC ARC HAZARD*.

3.7 ARC PROTECTIVE BLANKET – Flat protective cover used as a *barrier* for the protection of workers against arc flash and arc blast.

3.8 ARC-RATED (adj) – That which provides protection against the thermal effects of an electric arc under specific arc testing conditions.

NOTE: Arc-rating is given by an arc thermal performance value (ATPV) or a breakopen threshold energy (E_{BT50}), both associated to specific arc testing conditions.

3.9 AUTHORIZED – Having *approval* from the authority in control to perform a task(s) as required.

3.10 AUTHORIZED AGENT – A person, company or other legal entity endorsed to perform a task or role by, and on behalf of, another person, company or legal entity, or the authority in control.

3.11 AUTHORIZED WORKER – see *WORKER, AUTHORIZED*.

3.12 AUTOMATIC – Pertaining to equipment; self-acting, operating by its own mechanism when actuated by some impersonal influence as, for example, a change in current strength; not *manual*; without human intervention (i.e., remote control that requires human intervention is not *automatic*, but *manual*).

3.13 BACK-UP PROTECTION –

1. Co-ordination of two over-current protective devices in series where one protective device, generally but not necessarily on the supply side, affects the over-current protection with or without the assistance of the other protective device and prevents any excessive stress on the latter [Definition 2.5.24 of IEC 60947-1, modified]; and/or
2. Equipment or a system which is intended to operate when a system fault is not cleared in due time because of:
 - i. Failure or inability of a protective device closest to the fault to operate; or
 - ii. Failure of a protective device, other than the protective device closest to the fault, to operate. [Definition 3.4 of IEC 61892-2]

3.14 **BARRIER** –

1. Part providing protection against direct contact from any usual direction of access [Definition 3.8.8 of IEC 62128-1];
2. Physical entity that limits current and voltage into a hazardous area in order to satisfy intrinsic safety requirements [Definition 3.1.2 of IEC 61158-2]; and/or
3. *Engineered*, administrative or other form of *hazard* control intended to protect workers.

3.15 **BASKET** – see BUCKET.

3.16 **BLOCKING** –

1. Physically securing mechanical equipment against inadvertent movement; and
2. In the case of electrical installations, disabling or preventing a specific operation.

3.17 **BOND** – Electrical connection which causes conductive parts to be at an equal potential.

3.18 **BONDING** – Method of physically inter-connecting conductive parts to maintain an equal potential with the objective of avoiding harmful shock currents by minimizing any potential difference across a worker's body.

3.19 **BUCKET (BASKET)** – Device designed for attachment to the boom tip of a line truck, crane or aerial lift to support workers in an elevated working position; a type of *platform* (see also *PLATFORM*).

3.20 **CAPACITIVE COUPLING (ELECTRIC FIELD INDUCTION)** – Condition whereby the voltage of an energized line produces a voltage level on an adjacent isolated line or piece of equipment due to the existence of capacitance between the two objects. Capacitance exists due to the phenomenon of the electric field.

3.21 **CERTIFICATION** –

1. Third-party attestation related to products, processes, systems or persons [Definition of ISO/IEC 17000]; and/or
2. A record of training and/or experience to perform specific functions or duties.

NOTE: In Canada, a record of training and or experience may be required to obtain authorization from the authority having jurisdiction in order to perform such specific functions or duties.

3.22 CERTIFIED –

1. Possessing documentation in the form of written assurance that a product, process, or service conforms to specific requirements; and/or
2. Possessing a record of training and/or experience to perform specific functions or duties.

NOTE: In Canada, workers possessing a record of training and or experience may be required to obtain authorization from the authority having jurisdiction in order to perform such specific functions or duties.

3.23 CIRCUIT –

1. Conductor or system of conductors and equipment through which an electric current is intended to flow; and/or
2. In the distribution system, normal or actual configuration of a specific distribution *circuit* originating at a substation and extending to either normally open points (e.g., switches, open jumpers, disconnectors or other means of *isolation*) with other distribution *circuits*, or simply terminating at different end points (same as *FEEDER*). [Definition of IEC 61968-2]

3.24 CLEARANCE –

1. The distance between two conductive parts along a string stretched the shortest way between these conductive parts [Definition of IEC 60050 (441-17-31)]; and/or
2. Shortest distance measured in air between a conductive part(s) and an object that is *isolated* and/or *grounded*.

3.25 COMPETENT – Capable, by virtue of on the job training, intimate knowledge and experience, or performing the task at hand. Competency is attained primarily through experience.

3.26 COMPETENT BODY – Individual or organization which can demonstrate appropriate technical knowledge and relevant skills to make the necessary assessments of the safety aspect under consideration [Definition of IEC 60079-14].

3.27 COMPETENT WORKER – see *WORKER, COMPETENT*.

3.28 DEAD – see *DE-ENERGIZED*.

3.29 DEDICATED OBSERVER –

1. In transmission and distribution work, a worker that remains on the ground and observes *live work* being performed aloft. This worker does not perform other tasks on the ground unless all workers aloft cease activity; and/or
2. A worker that observes the work being performed without participating in the work.

3.30 DE-ENERGIZED (DEAD) – At a potential equal to or not significantly different from that of *ground* at the *worksite*. [Definition of IEC 60050 (651-21-09)]

3.31 *DIAGNOSTIC DEVICE* – Portable device used for assessing the status of electrical installations, as well as the tools, devices and equipment used for *live working*.

Example: *Voltage detectors, insulating stick testers* etc.

NOTE 1: Status could mean electrical, mechanical, chemical or environmental condition.

NOTE 2: The status may be in form of ON/OFF, GOOD/BAD, PRESENT/NOT PRESENT and will not require an interpretation from the user.

[Definition of IEC 60050 (651-24-01), modified, the NOTE 2 has been added]

3.32 *DYNAMIC ENERGY* – Energy produced through electromechanical and/or thermal processes and subsequently transformed into electrical energy.

3.33 *EARTH* – see *GROUND*.

3.34 *ELASTOMER* – Macromolecular material which returns rapidly to its initial dimensions and shape after substantial deformation by a weak stress and release of the stress.

NOTE 1: The definition applies under room temperature test conditions.

NOTE 2: *Elastomer* is a generic term that includes *rubber*, latex and elastomeric compounds that may be natural or synthetic or a mixture or a combination of both. It also includes thermoplastic elastomer (TPE) material.

[Definition of ISO 472 (2.327), modified, the NOTE 2 has been added]

3.35 *ELECTRIC ARC HAZARD* – A potential harm from an energy release from an electrical arc usually caused by a short *circuit* or equipment failure in electrotechnical work.

NOTE 1: The possibility of an *arc flash (electric arc) hazard* exists when live electrical conductors or parts are exposed or when they are inside of equipment even when *guarded* or enclosed, if a worker is interacting with the equipment in a way which could cause an electric arc. Under normal operating conditions, enclosed *energized* equipment that has been properly designed, installed and maintained is not likely to pose an *electric arc hazard*.

NOTE 2: The *hazards* may include thermal effects, noise, pressure wave effects, ejected parts effects, molten metal, optical and other effects. Different PPE may be required to protect from different effects. The *risk* assessment must consider all the potential effects.

NOTE 3: An arc flash is a high energy release consequence of an electric arc having been initiated. An arc flash can only occur when there is sufficient voltage and current (or fault current) capacity in the power system to sustain it. Typically, the arc flash is uncontrolled but will seek and try to follow a path to *ground*, neutral, or another phase until the power supply is interrupted. The occurrence of arc flash is usually triggered by a short *circuit* of *energized* conductors.

3.36 *ELECTROMAGNETIC INDUCTION* – Produces both an induced voltage and current. When the predominant effect is due to current, this is known as magnetic field induction.

3.37 *ENCLOSED* – Contained within a structure or assembly designed to surround the energized parts of an apparatus.

3.38 *ENGINEER* – A person in the engineering profession who has specific expertise in the matter under consideration and is licensed or registered to practice professional engineering.

NOTE : In Canada, licensing of engineers is authorized by provincial or territorial bodies.

[Definition of CAN/CSA Z150]

3.39 **ENGINEERED** – Has been studied/designed and stamped or sealed and signed by a professional *engineer* in such a manner that it is deemed to be safe for its intended purpose.

3.40 **ENERGIZED (LIVE)** – At a potential significantly different from that of *ground* (earth) at the *worksite* and which presents an electrical *hazard*.

NOTE: A part is *energized* when it is electrically connected to a source of electric energy. It can also be *energized* when it is electrically charged under the influence of an electric or magnetic field.

[Definition of IEC 60050 (651-21-08), modified, the definition has been put in line with the Canadian context]

3.41 **EQUIPOTENTIAL** – The state of having all objects in a work area at the same potential.

3.42 **EQUIPOTENTIAL BONDING** – Provision of electrical connections between conductive parts, intended to ensure they are *equipotential*. [Definition of IEC 60050 (826-13-19), modified, the definition has been modified in terms of the intention of the *bonding*]

3.43 **EQUIPOTENTIAL ZONE** – A work area, the bounds of which are set by the outermost point of conductive parts which are connected by an *equipotential bonding* or *grounding* system.

3.44 **ERGONOMIC DISTANCE** – Distance in air added to the electrical distance, to take into account inadvertent movement and errors in judgement of distances while performing work [Definition of IEC 60050 (651-21-13)]

3.45 **EXPOSED** –

1. For equipment:

Not *enclosed*, *insulated* or otherwise covered; or

2. For a person:

a situation where one is likely to meet with harm.

3.46 **FALL PROTECTION** – *Fall protection equipment* or work procedures acceptable to minimize the *risk* of injury to a worker from a fall.

3.47 **FALL PROTECTION EQUIPMENT** – A collection of equipment components configured to provide a system of travel restraint, fall restrict, work positioning or fall arrest.

3.47.1 **FALL ARREST SYSTEM** – A collection of equipment components configured to arrest a fall by a worker.

[Definition of CSA Z259.14]

3.47.2 **FALL RESTRICT SYSTEM** – A combination of a *work positioning system* and *fall restricting equipment*.

[Definition of CSA Z259.11]

3.47.2.1 FALL RESTRICT EQUIPMENT – A component of a *fall restrict system* (e.g. a modified pole strap or rigid but articulated frame) that, when combined with other subcomponents and elements, allows the climber of a wood pole to remain at his or her work position with both hands free, and performs a fall arrest function when contact is lost between the climber's spurs and the pole.

[Definition of CSA Z259.14]

3.47.2.2 WORK POSITIONING SYSTEM – An assembly of components that, when properly assembled and used together, supports a worker in a position or location so that the worker's hands are free in the work position.

[Definition of CSA Z259.11]

3.47.3 TRAVEL RESTRAINT SYSTEM – An assembly of components that, when properly assembled and used together and when connected to a suitable anchorage, prevents a worker from reaching an unprotected edge or opening where a fall could occur.

[Definition of CSA Z259.11]

3.48 FEEDER – see *CIRCUIT*.

3.49 GROUND – Reference for zero potential, also referred to as "*earth*" potential.

3.50 GROUNDING (EARTHING) –

1. Provision of a continuous conductive path to the earth that has sufficient ampacity to carry any fault current that may be imposed on it;
2. Has a sufficiently low impedance to limit the voltage rise above *ground* potential;
3. Facilitates the operation of the protective devices in the *circuit* as quickly as possible; and/or
4. Bleeds any excess energies induced by electric and magnetic fields or static sources.

3.51 GUARANTEE OF NON-RECLOSE – see *HOLD-OFF*.

3.52 GUARDED – Protected from inadvertent contact by the use of physical *barriers*.

3.53 HAND-DIGGING – To excavate using a shovel or other hand tool.

3.54 HAZARD – Potential source of harm.

NOTE: The term *hazard* can be qualified in order to define its origin or the nature of the expected harm (i.e. electric shock hazard, arc-flash hazard, crushing hazard, cutting hazard, toxic hazard, fire hazard, drowning hazard).

[Clause 3.5 of ISO/IEC Guide 51, modified]

3.55 HAZARDOUS ENERGY – Any electrical, mechanical, hydraulic, pneumatic, chemical or thermal energy, or force such as gravity, that could potentially harm workers.

3.56 HIGH VOLTAGE (HV) – Voltages equal to or greater than 50 001 V a.c. L-L or d.c.

3.57 HOLD-OFF – An administrative assurance that *reclosing* on protective devices (both *automatic* and *manual*) is disabled. Also called "*guarantee of non-reclose*".

3.58 **HYDRO EXCAVATION (HYDROVAC)** – The use of pressurized water or compressed air to loosen soil and a vacuum system to remove it.

[Definition of ESA Guideline for Excavation in the Vicinity of Utility Lines]

3.59 **INCIDENT ENERGY** – Heat energy (total heat) received at a unit surface area as a result of an electric arc [Definition of CAN/ULC-61482-1-1, modified, notes have been deleted].

3.60 **INSTRUCTED** – Provided with information and direction with respect to particular subject matter.

3.61 **INSULATED** – Having sufficient *insulating* covering, dielectric separation and/or airspace to prevent a significant flow of current (i.e., current that can cause personal injury or harm to equipment) between objects at different potentials.

3.62 **INSULATING** – Property of a material, tool, device or equipment that limits the current flow to a negligible value when under electrical stress.

3.63 **INSULATOR** – Device intended for electrical *insulation* and mechanical fixing of equipment or conductors which are subject to electric potential differences. [Definition of IEC 60050 (471-01-10)]

3.64 **ISOLATE** – To disconnect completely a device or *circuit* from other devices or *circuits*, separating it physically, electrically and mechanically from all sources of electrical energy.

NOTE: Such separation may not eliminate all of the effects of electromagnetic induction.

3.65 **ISOLATED** –

1. Not readily *accessible* unless special means of access are used; or
2. Disconnected or separated from all system sources of *dynamic energy*.

3.66 **LIMIT OF APPROACH** – see *MINIMUM APPROACH DISTANCE*.

3.67 **LIVE** – see *ENERGIZED*.

3.68 **LIVE MAINTENANCE** – Maintenance activities performed while associated apparatus, intrinsically safe apparatus and *circuits* are *energized*.

3.69 **LIVE PART** – Conductor or conductive part intended to be *energized* in normal use, including a neutral conductor but, by convention, not a PEN conductor.

NOTE: A PEN conductor is a protective earthed neutral conductor combining the functions of both a protective conductor and a neutral conductor.

3.70 **LIVE WORKING (LIVE WORK)** – Activity in which a worker makes intentional contact with *energized* parts or encroaches inside the *live working zone* with either parts of his or her body or with tools, devices and equipment.

NOTE 1: Examples of *live working* include: replacement of *insulators* and spacers, the cleaning of *insulators* and *energized* parts and the replacement of other installation components.

NOTE 2: *Live working* is performed using specific methods such as:

- Hot stick working,
- *Insulating* glove working,
- Bare hand working.

[Definition of IEC 60050 (651-21-01), modified, notes have been deleted]

3.71 *LIVE WORKING ZONE* – Space around *energized* parts where reduction of electrical risk is managed by restricting access to skilled persons only, by maintaining the appropriate air distances to parts at a different electric potential and by using tools for *live working*.

NOTE 1: The distance from the *energized* parts to the outer boundary of a *live working zone* is greater or equal to the sum of the electrical distance appropriate for the maximum nominal voltage and of the selected *ergonomic distance*.

NOTE 2: The *live working zone* and the specific precautions that apply are generally defined by national or company regulations.

[Definition of IEC 60050 (651-21-03), modified, notes have been deleted]

3.72 *LOCATE* – Identification on the ground of the position of the utility line(s) and related underground infrastructure based on records or electronic locating equipment and includes provision of necessary documentation such as a locate sheet.

[Definition of ESA Guideline for Excavation in the Vicinity of Utility Lines]

3.73 *LOCKOUT* – Application of a lock to an *isolating* device to prevent its operation; see also *TAGGING*.

3.74 *LOW VOLTAGE (LV)* – Voltages equal to or less than 1 000 V a.c. L-L or 1 500 V d.c.

3.75 *MANUAL* – Control state for equipment which requires human action to perform an operation or cause a change of state.

3.76 *MEASURING DEVICE* – Portable device intended to be used to make measurements and to display values.

NOTE 1: Measuring devices could be used alone or in conjunction with supplementary devices.

[Definition of IEC 60050 (311-03-01), modified, the definition has been put in line with the Canadian context.]

3.77 *MECHANICAL EXCAVATION* – Boring or open cut excavation by means of mechanical excavating equipment such as powered excavator, earth mover, earth piercing equipment including hand held augers and other mechanical equipment.

[Definition of ESA Guideline for Excavation in the Vicinity of Utility Lines, modified]

3.78 *MEDIUM VOLTAGE (MV)* – Voltages between 1 001 V a.c. L-L to 50 000 V a.c. L-L or 1 501 V d.c. to 50 000 V d.c.

3.79 *MINIMUM APPROACH DISTANCE (MAD)* – Also referred to as “Minimum Working Distance”.

1. The minimum distance in air to be maintained between any part of the body of a worker, including any object (except tools appropriate for *live working*) being handled directly, and any part(s) at different potential(s).

NOTE: The *minimum approach distance* is the sum of the electrical distance appropriate for the maximum nominal voltage and of the selected *ergonomic distance*.

[Definition of IEC 60050 (651-21-11)]

2. The *MAID* plus a modifier for *ergonomic distance* [Definition 3.42 of IEEE 516, modified].

3.80 MINIMUM AIR INSULATION DISTANCE (MAID) – Shortest distance in air between an *energized* electrical apparatus and a line worker's body at different potential. With a floating electrode in the gap, it is the sum of the individual *minimum approach distances*. This is an electrical component and does not include any factor for inadvertent movement of a worker. [Definition of IEEE 516]

3.81 NEAR – For the purposes of electrical operations, distance at which there is a possibility of contacting *energized* lines or equipment.

3.82 NOMINAL VOLTAGE – The voltage by which a *circuit* is designated.

NOTE: The operating voltage of a system may vary above or below this value.

[Definition of CSA-C235]

3.83 PERSONAL PROTECTIVE EQUIPMENT (PPE) – Equipment used to protect persons from harm in the working environment.

NOTE: PPE includes such items as special tools, protective clothing, gloves, hearing protection, respiratory protection, head, eye, face, foot and *fall protection equipment*, *insulating* screening and safety signs.

[Clause 3.17 of IEC 61821, modified]

3.84 PHASE COMPARATOR (PHASING TESTER) – Portable device used to provide clear evidence of the presence or the absence of the correct phase relationship between two *energized* parts at the same nominal voltage and frequency.

3.85 PLATFORM –

1. Personnel-carrying component of an *aerial device* such as a *bucket (basket)*, stand or equivalent [Definition of CAN/CSA-C225]; and/or
2. Device intended to support workers (i.e., a diving board for *live work*).

3.86 PORTABLE BOND MAT – A mat that creates an *equipotential zone* for the worker to stand during various *energized* and *de-energized* work practices.

3.87 PORTABLE EQUIPMENT FOR EARTHING (GROUNDING) OR EARTHING (GROUNDING) AND SHORT-CIRCUITING (BONDING) – Equipment, which is portable and is capable to be carried by one person and manually or mechanically connected with its insulating component to parts of an electrical installation for earthing (grounding) or short-circuiting (bonding) or earthing (grounding) and short-circuiting (bonding) purposes.

NOTE 1: The *portable equipment for earthing (grounding) or earthing (grounding) and short-circuiting (bonding)* comprises the earthing (grounding) and short-circuiting (bonding) device and one or more specific detachable or non-detachable *insulating* components.

NOTE 2: The use of *insulating* component is to safely connect the devices to the connecting points.

NOTE 3: The *portable equipment for earthing (grounding) or earthing (grounding) and short-circuiting (bonding)* is installed temporarily on isolated power circuits for the purposes of potential equalization and to help protect the worker by conducting a short-circuit current for a specified duration (time).

NOTE 4: The aim of the earthing (grounding) and short-circuiting (bonding) of disconnected or isolated parts of installations is to provide a control path to the short-circuit current and secondly to prevent the voltage rise in the earth (ground) *circuit*.

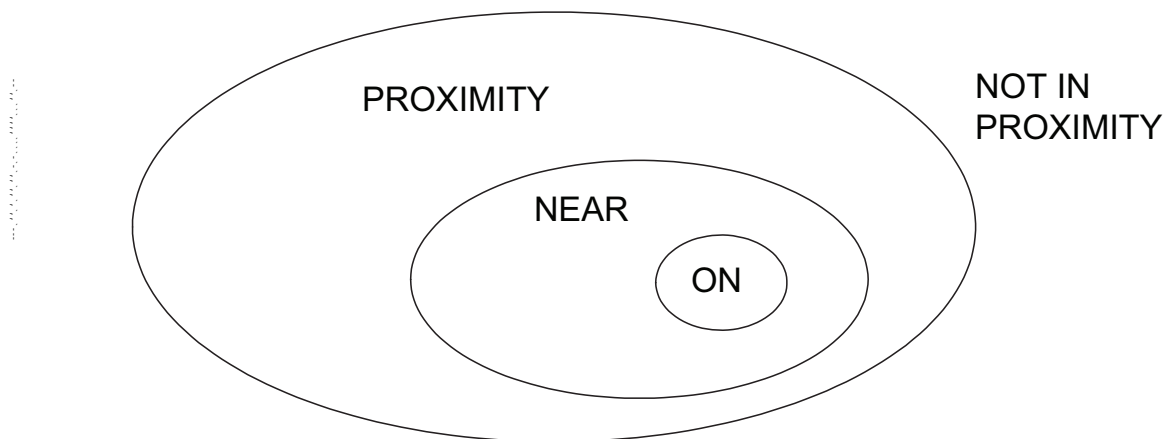
[Definition of CAN/ULC-61230]

3.88 **PRACTICABLE** – Capable of being accomplished with existing technology.

3.89 **PRACTICAL** – Easily and readily possible.

3.90 **PROXIMITY** – For the purposes of electrical operations, distance at which there is a possibility of exposure to an adverse effect (e.g. *arc flash hazard*, radio frequencies, electromagnetic frequencies).

NOTE: When there is some possibility of exposure to an adverse effect, refer to diagram below for the relationship between on, *near* and *proximity*.



3.91 **QUALIFIED WORKER** – see WORKER, QUALIFIED.

3.92 **RATED** – A qualifying term that, applied to an operating characteristic, indicates the designated limit or limits of the characteristic for application under specified conditions.

NOTE: The specific limit or limits applicable to a given device is specified in the standard for that device, and included in the title of the *rated* characteristic, that is, *rated* maximum voltage, *rated* frequency range, etc.

[Definition of IEEE C37.100]

3.93 **RECLOSING** – The practice of having a device close after an opening operation, usually *automatically*.

3.94 **RISK** – Combination of the probability of occurrence of harm and severity of that harm.

[Definition of ISO/IEC Guide 51].

3.95 **RUBBER** – see ELASTOMER.

3.96 **SHALL** – A requirement; something that must be done in order to comply with a standard.

3.97 **SHOULD** – A recommendation; something that is advised but not required.

3.98 **STATIC CHARGE** – An accumulation of an electrical charge on an isolated system.

NOTE: Even in the absence of an a.c. electric and magnetic field, a charge may accumulate by such effects as d.c. circuits, wind, cloud movement or solar flares.

3.99 **SUBSURFACE CHAMBER** – Below-ground enclosure large enough for a person to enter and affording facilities for placing and maintaining underground conductors, cables and associated apparatus.
[Definition of CAN/CSA C22.3 No.7]

3.100 **SWITCHING** – Process by which the electrical configuration of a system is changed, usually through the operation of devices designed for this action, but may also include the removal or installation of jumpers and the making or breaking of normally permanent connections.

3.101 **TAGGING** – Act of placing a physical tag on a device, normally as the device is turned off for servicing or *isolated* from network access (locked out) as a safety measure. A device may also be tagged to provide information regarding a condition.

3.102 **UTILITY ARBOURIST** – A *qualified worker* who has received formal, documented training in all aspects of pruning and clearing woody plants near *exposed energized* electrical lines and equipment during utility line clearing operations or residential pruning operations.

3.103 **UTILITY ARBOURIST-IN-TRAINING** – A *competent worker* undergoing formal in-class instruction and supervised field practice in utility arbouriculture.

3.104 **VAULT** – Room or space for electrical equipment to reside; may be a *subsurface chamber*. A *vault* within a building also provides fire and explosion protection.

3.105 **VOLTAGE DETECTOR** – A device used to provide clear evidence of the presence or absence of the operating voltage.

3.106 **WORKER** – A person who performs work or supplies services for monetary compensation.

AUTHORIZED WORKER – Worker(s) approved to access or to work on the electric utility system or associated equipment by the owner and/or the employer.

NOTE: In Canada, workers may be approved by the owner of the utility or their designate.

COMPETENT WORKER – Worker(s) capable by virtue of on the job training, intimate knowledge and experience to perform the task at hand. (see *COMPETENT*).

QUALIFIED WORKER – Worker(s) who, through possession of a recognized degree, certificate, professional standing or through extensive knowledge, training and experience has successfully demonstrated the ability to perform the required duties and tasks of the work.

NOTE: The user should be aware that in Canada, the authority having jurisdiction may require these workers to obtain *certification*.

UNQUALIFIED WORKER – Worker(s) who is not a *qualified worker* (i.e. does not possess a recognized degree, certificate, professional standing or has not, through extensive knowledge, training and experience, demonstrated his or her ability to perform the required duties and tasks of the work.)

UTILITY WORKER – Worker(s) who perform tasks associated with the construction, operation or maintenance of an electric utility system.

NOTE: A *utility worker* may be directly employed by a utility or contracted to a utility.

3.107 **WORKER IN CHARGE** – Person designated to direct the work at one or more *worksites*.

NOTE: A *worker in charge* may be a manager, foreman, supervisor, worker tradesman or other person designated by the employer.

3.108 **WORKPLACE** – A location where a worker is employed, such as an office, generating station, or major facility under construction.

NOTE: The *workplace* refers to the work setting in general and not necessarily the *worksite*.

3.109 **WORKSITE** – The immediate location where a worker works or is likely to be engaged in work and includes any vehicle or mobile equipment used by a worker when at work.

4. FUNDAMENTAL REQUIREMENTS

4.1 ROLES & RESPONSIBILITIES

4.1.1 Employers

4.1.1.1 Protection for Workers

4.1.1.1.1 Every employer shall ensure:

- A The safety and health at work of all its workers;
- B Only *qualified* and *authorized workers* perform work on the power system;

- C Workers or worker representatives are consulted in the development of safety requirements;
- D Workers perform work in accordance with applicable safety rules, policies and procedures as established by the employer;
- E A copy of the safety rules, policies and procedures established by the employer are made available to each worker, as well as training, as appropriate;
- F Workers are *instructed* in the proper use, care and limitations of all tools, devices, equipment and PPE required for their protection;
- G A worker being trained to perform a work activity is under the direct and immediate supervision of a *qualified worker*, and
- H A safe work plan is completed before any job commences and all workers at the *worksite* are informed of the safe work plan. Work shall be discontinued while the safe work plan is updated should conditions at the *worksite* change.

4.1.1.2 Safety Training

4.1.1.2.1 Every employer shall ensure its workers are:

- A *Instructed* and trained in rescue, first aid and resuscitation techniques, if their duties warrant such training;
- B *Instructed* on the proper operation of all tools and equipment they are required to operate; and
- C Trained in the proper procedures, practices and techniques to carry out their work in a safe manner.

4.1.1.3 Equipment

4.1.1.3.1 Every employer shall ensure that all material, equipment and machinery provided for the use of workers at a *workplace* are:

- A Properly maintained, free from defects, and equipped with appropriate safety features or devices, as recommended by the manufacturer or required by regulation or approved by the utility; and
- B Used in the manner for which they are intended.

4.1.1.4 Monitoring

4.1.1.4.1 Every employer shall ensure that:

- A *Workplace* safety observations and/or inspections are conducted; and
- B Workers comply with safety rules, policies and procedures as established by the employer.

4.1.1.5 Worker in Charge

4.1.1.5.1 If more than one worker is required to work at any *worksite* on or *near* the same electrical equipment or line, the employer shall ensure that a *worker in charge* is designated.

4.1.1.5.2 An employer shall ensure that the *worker in charge* instructs all workers under their control in the safe performance of the work.

4.1.1.5.3 When more than one work group is working at the same *worksite*, a *worker in charge* shall be designated to coordinate the safety of all work groups at the *worksite*. Similar coordination may be necessary at multiple *worksites* when activities overlap.

4.1.1.5.4 Any worker designated in charge shall be trained in *worker in charge* responsibilities.

4.1.1.6 Visitors

4.1.1.6.1 If workers or visitors unfamiliar with electrical *hazards* are permitted by an employer to enter a normally restricted area where there is *exposed energized* electrical equipment, the employer shall ensure the workers or visitors are continuously supervised by a *qualified worker* from the utility, who is capable of ensuring their safety.*

4.1.2 Workers

4.1.2.1 Rules Governing Workplace Safety*

4.1.2.1.1 Every worker, while at work, shall:

- A Know and understand the safety rules, policies and procedures as established by the employer, and be able to demonstrate such knowledge and understanding when called upon to do so;
- B Comply with all safety rules, policies and procedures as established by the employer;
- C When working on or *near energized* lines and equipment, consider all of the effects of their actions, taking into account their own safety as well as the safety of other workers at the *worksite* or working on some other part of the affected electric system, the property of others and the public in general;
- D Use all tools, devices and equipment and wear all PPE (including clothing) designated by the employer, or required by regulation for the task at hand;
- E Comply with safety signs and signals and warn others who are in danger or *near energized* equipment or lines; and
- F Keep away from all parts of the electric system that are not required to be worked on.

4.1.2.2 Safe Work Practices

4.1.2.2.1 Every worker shall:

- A Perform work on or *near energized* electrical equipment only if they are a *qualified worker*;
- B Request clarification as required from the supervisor or the *worker in charge* to ensure the safe performance of assigned work; and
- C Be an *authorized worker*.

*Portions reprinted, with permission, from Part 4 of IEEE C2-2012, National Electrical Safety Code, Copyright 2012 IEEE.

4.1.2.3 Tools, Devices and Equipment

4.1.2.3.1 Every worker shall:

- A Use only tools, devices and/or equipment suited to the work being performed; and
- B Ensure the required protective devices, equipment and PPE are used in accordance with the rules, policies and procedures established by the employer.

4.1.2.4 Report Unsafe Practices and Defective Equipment

4.1.2.4.1 Where a worker finds, or believes, that any item, device, material equipment or machinery, condition or aspect of the *workplace* or work practice is, or may be, imminently hazardous to the worker's own safety or that of others, the worker shall:

- A Discontinue planned work until the situation has been addressed;
- B Immediately report the hazardous situation to the employer;
- C Take steps to guard and ensure no one is harmed by the situation;
- D Where *practicable*, ensure that the hazardous condition is controlled and made safe; and
- E Seek (together with the employer) to eliminate the *hazard* entirely.

4.1.2.4.2 Unsafe practices and defective equipment that shall be reported include, but are not limited to:

- A Electrical line or equipment defects such as abnormally sagging wires, broken *insulators*, broken poles or lamp supports;
- B Accidentally *energized* objects such as conduits, light fixtures, or guy wires; and
- C Other defects that may cause a hazardous condition.

4.1.2.5 Number of Workers Required

4.1.2.5.1 Where any worker deems it unsafe to undertake work alone, it shall be their duty to follow the employer's procedures to summon such help as is required.

NOTE: It is the responsibility of the employer to provide such help as is considered reasonable to maintain safe conditions or meet regulations.

4.2 WORKER QUALIFICATIONS

4.2.1 General

4.2.1.1 For all work to be performed on or *near exposed energized* electrical lines and equipment, the employer shall ensure that workers are qualified for the work and *authorized* to access the required parts of the electric utility system. *

*Portions reprinted, with permission, from Part 4 of IEEE C2-2012, National Electrical Safety Code, Copyright 2012 IEEE.

4.2.2 Qualification of Workers

4.2.2.1 To be recognized as a *qualified worker*, a worker shall:

- A Be trained in the skills necessary to safely and proficiently carry out all tasks assigned; and
- B Demonstrate competence in carrying out such tasks.

4.2.3 Authorization Requirements

4.2.3.1 To be *authorized* to perform work, a worker shall:

- A Be trained in all safe work procedures relevant to the part of the electric utility system and class of work being performed; and
- B Demonstrate competence in the application of the safe work procedures.

4.2.4 Special Qualification and Authorization

4.2.4.1 It is recognized that in a specific work situation, a worker who is not a *qualified worker* on the electric utility system may be specially qualified and *authorized* to work *near exposed energized* electrical lines and equipment. To attain this special qualification and authorization status, the employer shall ensure the worker:

- A Is trained in technical and safe work procedures acceptable to the electric utility; and
- B Meets the authorization requirements of Clause 4.2.3.

NOTE: It may be deemed necessary to have a *qualified worker* present to “safety watch” the worker.

4.2.5 Unqualified Workers

4.2.5.1 Workers who are not qualified to work on or *near* the electric utility system shall not encroach within the *Minimum Approach Distance* (MAD) for *unqualified workers* specified for the voltage level of the electrical lines and equipment unless they:*

- A Perform only tasks directed by a *qualified worker*; and
- B Are under the continuous and direct supervision of a *qualified worker*.

4.3 IDENTIFICATION AND LOCATION

4.3.1 Fundamental Requirements

4.3.1.1 All electrical components used in the control of an electrical generation, transmission or distribution system shall be identified so their locations and configurations are known and can be confirmed before work is undertaken.

4.3.1.2 Records shall be maintained on all electric utility systems, such as civil and electrical drawings or diagrams identifying location and normal operating status.

*Portions reprinted, with permission, from Part 4 of IEEE C2-2012, National Electrical Safety Code, Copyright 2012 IEEE.

4.3.1.3 Records shall be readily available for the purposes of initiating or performing work on the electric utility system and verifying any location or operating status.

4.3.1.4 Main underground facilities shall have their geographic location and configuration mapped.

4.3.1.5 The operating voltage of all *energized* equipment shall be known and the physical locations shall be confirmed before undertaking work on or *near* the electric utility system.

4.3.2 Identification Requirements

4.3.2.1 All stations, control centres, transmission *circuits* and major distribution *circuits* shall have unique designations.

4.3.2.2 All equipment that is used for *switching* on the electric utility system shall have unique identifiers.

4.3.3 Electric Utility System Status*

4.3.3.1 All electrical lines and equipment on an electric utility system shall be considered *energized* unless they are confirmed to be *de-energized*.

4.3.3.2 Before starting work, inspections or tests shall be conducted to verify the condition and power system status of the lines and equipment involved.*

4.4 WORK PLANNING

4.4.1 Fundamental Requirements

4.4.1.1 The employer shall have in place a process for project safety planning and safe work planning as well as pre-job on-site safe work planning for all work on an electric generation, transmission or distribution system.

4.4.2 Project Safety Planning

4.4.2.1 A project safety plan should be developed for large, complex or high *risk* projects that are generally lengthy in duration and may present unusual or unexpected *hazards*. In the initial stages, after a project has been identified as complex, a site visit should be conducted in order to identify and document:

- A High *risk hazards* with potentially fatal consequences; and
- B Critical issues or conditions which may impede safe completion of the project (outage requirements, equipment location and status, specialized equipment, work methods or training required, etc.).

4.4.2.2 All workers affected by the project safety plan shall be informed of the *hazards* that affect them. Refer to Appendix A – Figure A2, Project Planning Hazard Assessment Report Form.

*Portions reprinted, with permission, from Part 4 of IEEE C2-2012, National Electrical Safety Code, Copyright 2012 IEEE.

4.4.3 Safe Work Planning

4.4.3.1 A safe work plan shall be completed for every job and it shall be revised whenever conditions at the *worksite* change. Safe work plans identify job steps, associated *hazards* and the methods to be used to eliminate or control the *hazards*. The plans may identify specific duties for each job step. Emergency response for the work activities are also part of a safe work plan. Refer to Appendix A – Figure A1, Safe Work Plan Hazard Assessment & Emergency Response Plan Template.

4.4.4 Hazard Identification, Elimination, Risk Assessment & Control

4.4.4.1 Employer's Responsibility

4.4.4.1.1 Employers shall evaluate the electrical utilities' *work place* to identify *hazards*.

4.4.4.1.2 *Hazard* identification shall be conducted by a *competent worker*.

4.4.4.1.3 *Hazards* identified shall be subjected to a *risk* assessment.

4.4.4.1.4 Controls for the *hazards* shall be identified.

4.4.4.1.5 Residual *risk* shall be communicated to workers.

NOTE: Residual *risk* is that which is remaining after a hierarchy of controls has been implemented. [Definition of CSA Z1002]

4.4.4.1.6 Controls identified by the employer shall be available to workers at the *worksite*.

4.4.4.2 Worker's Responsibility

4.4.4.2.1 Worker's shall be *competent* in *hazard* identification at the *worksite* and shall conduct the identification before work begins.

4.4.4.2.2 *Hazards* at the *worksite*, other than those identified by the employer, shall be subjected to a *risk* assessment by a *competent worker*.

4.4.4.2.3 Controls shall be established for the additional *hazards* identified.

4.4.4.2.4 Residual *risk* determined at the *worksite* shall be communicated to the workers on site.

4.4.4.2.5 Residual *risk* that is deemed not acceptable shall be communicated to the employer and all work at the *worksite* shall be stopped.

4.4.4.2.6 Workers shall be *competent* in working with residual *risk* at the *worksite*.

4.4.4.2.7 Workers shall apply all controls identified by the employer as well as those established at the site.

4.4.5 Approach to Elimination and Control

4.4.5.1 *Hazards* should be eliminated or controlled through the use of *engineered* solutions.

4.4.5.2 *Hazards* identified shall be subjected to the following hierarchy of controls

A Eliminate the *hazard*;

- B Substitute with other materials, processes or equipment;
- C Reduce the *risk* by design;
- D Use work systems that increase awareness of potential *hazards* e.g. apply safeguards like signage, *barriers*, etc.;
- E Implement administrative controls (e.g. training and procedures); and
- F Use PPE, as a last line of defense, and ensure it is appropriately used and maintained.

4.4.6 Record Keeping

4.4.6.1 Where the employer's process or where the authority having jurisdiction requires a documented safe work plan, the *hazard* assessment and the methods used to eliminate or control the *hazards* shall be recorded.

4.4.7 Emergency Response to an Uncontrolled Hazard

4.4.7.1 If emergency response is required to eliminate or control a *hazard* that is dangerous to the safety of workers and the public, then only workers *competent* to eliminate or control that *hazard* shall be *exposed* to the *hazard*.

4.5 PERSONAL PROTECTIVE EQUIPMENT (PPE)

4.5.1 General PPE

4.5.1.1 *Personal protective equipment* (PPE) shall be selected and used to protect the worker based on the *hazard* or hazards to which the worker is *exposed*.

4.5.1.2 Workers shall use PPE approved by the utility to protect their health and safety.

4.5.1.3 Workers shall inspect their PPE prior to use to ensure it is in good condition.

4.5.2 Head Protection

4.5.2.1 Head protection shall be in compliance with CAN/CSA-Z94.1, Industrial Protective Headwear – Performance, Selection, Care and Use, or an industry standard(s) of equivalent or greater worker protection.

4.5.3 Eye and Face Protection

4.5.3.1 Eye and face protection shall be in compliance with CSA-Z94.3, Eye and Face Protectors, or an industry standard(s) of equivalent or greater worker protection. Also reference should be made to CSA-Z94.3.1, Selection, Use and Care of Protective Eyewear.

4.5.3.2 Workers *exposed* to electric arcs shall wear *arc-rated* protection that complies with (or meets the requirements of) ASTM F2178, Standard Method for Determining the Arc Rating and Standard Specification for Eye or Face Protective Products, or an industry standard(s) of equivalent or greater worker protection.

4.5.4 Hearing Protection

4.5.4.1 Hearing protection devices shall be in compliance with CAN/CSA-Z94.2, Hearing Protection Devices – Performance, Selection, Care and Use, or an industry standard(s) of equivalent or greater worker protection.

4.5.5 Skin (Body) Protection

4.5.5.1 Metallic or synthetic jewelry (e.g. watches, rings, piercings) shall not be worn in contact with the skin while working on or *near exposed energized* lines or equipment.

4.5.5.2 *Arc-rated* outerwear with *arc-rated* clothing or non melting clothing beneath the outerwear shall be worn by workers *exposed* to electric arcs or flash fire *hazards*. For more details, refer to Section 8., Arc Flash Protection.

4.5.5.3 Testing for thermal *hazards* of an electric arc shall be done in compliance with the following standard(s) as applicable, or an industry standard(s) of equivalent or greater worker protection:

- A CAN/ULC-61482-1-1, Live working – Protective clothing against the thermal hazards of an electric arc – Part 1: Test methods - Method 1 – Determination of the arc rating (ATPV or E_{BT50}) of flame resistant materials for clothing;
- B ASTM F1959, Standard Test Method for Determining the Arc Rating of Materials for Clothing;
- C ASTM F2621, Standard Practice for Determining Response Characteristics and Design Integrity of Arc Rated Finished Products in an Electric Arc Exposure; and/or
- D ASTM F2675, Standard Test Method for Determining Arc Ratings of Hand Protective Products Developed and Used for Electrical Arc Flash Protection.

4.5.5.4 Where the risk of exposure to a hydrocarbon flash fire exists, such as during a fault in oil filled electrical equipment, protective clothing should be in compliance with the following standard, or an industry standard(s) of equivalent or greater worker protection:

- A CAN/CGSB-155.20, Workwear for Protection Against Hydrocarbon Flash Fire;
- B NFPA 2112, Standard on Flame- Resistant Garments for Protection of Industrial Personnel Against Flash Fire.

4.5.5.5 *Arc-rated* clothing shall be in compliance with the following standards as applicable, or an industry standard(s) of equivalent or greater worker protection:

- A CAN/ULC-61482-2, Live working – Protective clothing against the thermal hazards of an electric arc – Part 2: Requirements;
- B ASTM F1506, Standard Performance Specification for Flame Resistant Textile Materials for Wearing Apparels for Use by Electrical Workers Exposed to Momentary Electrical Arc and Related Thermal Hazards; and
- C ASTM F1891, Standard Specification for Arc and Flame Resistant Rainwear.

4.5.5.6 Conductive clothing shall be in compliance with the following standards as applicable, or an industry standard(s) of equivalent or greater worker protection:

- A CAN/ULC-60895, Live Working – Conductive Clothing for Use at a Nominal Voltage up to 800 kV a.c. and ± 600 kV d.c.;
- B CAN/ULC-61482-2, Live working – Protective clothing against the thermal hazards of an electric arc – Part 2: Requirements;
- C ASTM F1506, Standard Performance Specification for Flame Resistant and Arc Rated Textile Materials for Wearing Apparel for Use by Electrical Workers Exposed to Momentary Electric Arc and Related Thermal Hazards;
- D ASTM F1959, Standard Test Method for Determining the Arc Rating of Materials for Clothing; and
- E ASTM F2621, Standard Practice for Determining Response Characteristics and Design Integrity of Arc Rated Finished Products in an Electric Arc Exposure.

4.5.6 Foot Protection

4.5.6.1 General safety protective footwear shall be in compliance with CAN/CSA-Z195, Protective Footwear, or an industry standard(s) of equivalent or greater worker protection.

4.5.6.2 Dielectric *rated* overshoe footwear shall be in compliance with ASTM F1117, Standard Specification for Dielectric Footwear, or an industry standard(s) of equivalent or greater worker protection.

4.5.6.3 For conductive footwear for *live working*, refer to Clause 6.2.9.2 for applicable standards.

4.5.7 Hand Protection

4.5.7.1 If a worker can be exposed to an *electrical arc hazard*, hand protection should be in compliance with ASTM F2675, Standard Test Method for Determining Arc Ratings of Hand Protective Products Developed and Used for Electrical Arc Flash Protection, or an industry standard(s) of equivalent or greater worker protection.

4.5.7.2 If *rubber insulating* gloves with leather protectors are required, additional leather or *arc-rated* gloves shall not be required. The combination of *rubber insulating* gloves with leather protectors satisfies the arc flash protection requirement.

4.5.8 Fall Protection

4.5.8.1 Every employer shall develop, implement, and maintain an effective *fall protection* program applicable to climbing or otherwise accessing and working from elevated work locations, which shall include all of the following:

- A Training, retraining and documentation;
- B Guidance on equipment selection, inspection, care and maintenance;
- C Structural design and integrity considerations, with particular reference to anchorages and their availability;
- D Rescue plans and related training; and
- E *Hazard* recognition.

4.5.8.2 At elevated locations where a fall of 3 m (10 ft) or more may occur or where there is an unusual possibility of injury if a worker falls less than 3 m (10 ft), a *fall protection* system shall be used.*

4.5.8.3 *Fall protection* systems shall be considered in the order listed below, and the system which offers the best protection and is *practicable* shall be selected:

- A Engineer out the *hazard*;
- B *Travel restraint system*;
- C *Fall restrict system*;
- D *Work positioning system*;
- E *Fall arrest system*; or
- F Written work procedures to minimize the *risk* of falling.

4.5.8.4 *Fall protection equipment* shall be inspected before use by the worker to ensure the equipment is in safe working condition.

4.5.8.5 *Fall protection equipment* shall be attached to a secure connecting point capable of safely withstanding the maximum arresting force that may be applied to it.

4.5.8.6 A full body harness shall be required when a *fall arrest system* is used.

NOTE: Pole climbing equipment and fixed ladder *engineered* climbing systems are normally considered *fall restrict systems*.

4.5.8.7 The worker shall determine that all components of the *fall protection* system are properly engaged and that the worker is secure.

4.5.8.8 *Fall protection equipment* shall be in compliance with the following CAN/CSA-Z259 series of *fall protection* standards, or an industry recognized standard(s) of equivalent or greater worker protection:

- A CAN/CSA-Z259.1, Body Belts and Saddles for Work Positioning and Travel Restraint;
- B CAN/CSA-Z259.2.1, Fall Arresters, Vertical Lifelines and Rails;
- C CSA-Z259.2.2, Self-Retracting Devices ;
- D CAN/CSA-Z259.2.3, Descent Devices;
- E CAN/CSA-Z259.10, Full Body Harness;
- F CSA-Z259.11, Energy Absorbers and Lanyards;
- G CAN/CSA-Z259.12, Connecting Components for Personal Fall Arrest Systems (PFAS);
- H CAN/CSA-Z259.13, Flexible Horizontal Lifeline System;
- I CAN/CSA-Z259.14, Fall Restrict Equipment for Wood Pole Climbing;

*Portions reprinted, with permission, from Part 4 of IEEE C2-2012, National Electrical Safety Code, Copyright 2012 IEEE.