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**Electrical Distribution Safety**

## **GENERAL:**

This bulletin highlights some of the most commonly referenced technical codes, publications and standards when reviewing a connection to Distributed Generation under the Feed-in Tariff (FIT) Program, including “micro-FIT”.

NOTE: This bulletin is not intended to identify all codes, publications and standards.

## **NATIONAL STANDARD – TECHNICAL REQUIREMENTS:**

Canadian Standards Association has published a standard entitled “CAN/CSA- C22.3 No. 9-08 - Interconnection of Distributed Resources and Electricity Supply Systems”. This standard establishes connection practices by providing technical requirements for the interconnection of distributed generation systems and electricity supply systems. In the Appendix of this bulletin additional reference material is indicated, with respect to technical connections. CAN/CSA- C22.3 No. 9-08 may be obtained from

<http://www.shopcsa.ca/onlinestore/welcome.asp>.

## **ESA GUIDELINE - SAFETY REQUIREMENTS:**

ESA has published guidelines such as “Electrical Guidelines for Inverter-Based Micro-Generating Facility – 10kW and Smaller”. This guideline simplifies the safety requirements (safety regulations, codes, and associated standards) before installing any type of distributed generation 10kW and smaller, whether it is stand-alone or connected to the grid.

This guideline may be obtained from:

[http://www.esasafe.com/pdf/Micro\\_Embedded\\_Generation\\_Facilities\\_Guidelines.pdf](http://www.esasafe.com/pdf/Micro_Embedded_Generation_Facilities_Guidelines.pdf)

or for hardcopies, contact

[Utility.Regulations@ElectricalSafety.on.ca](mailto:Utility.Regulations@ElectricalSafety.on.ca)



## **ADDITIONAL INFORMATION:**

If you can provide additional information on this Bulletin or any other Utility issue, please contact ESA to share your experiences. Additional information requests, and follow-up information, may be directed to ESA. Please be prepared to quote Bulletin “DIB-09/09”.

## APPENDIX

1. **ESA-SPEC-004** – Electrical Guidelines for Inverter-Based Micro-Generating Facility, 10kW and Smaller
2. **ESA-SPEC-005**– Process Guideline for the Installation of Parallel Generating Systems, 10kW or Greater
3. **Ontario Electrical Safety Code 24<sup>th</sup> Edition / 2009**
4. **IEEE Std 1547-2003** - IEEE Standard for Interconnecting Distributed Resources with Electric Power Systems
5. **IEEE Std 1547.1-2005** - IEEE Standard Conformance Test Procedures for Equipment Interconnecting Distributed Resources with Electric Power Systems
6. **IEEE P1547.2** - Application Guide for IEEE Standard 1547, Interconnecting Distributed Resources with Electric Power Systems
7. **IEEE Std 1547.3-2007** - IEEE Guide for Monitoring, Information Exchange, and Control of Distributed Resources Interconnected with Electric Power Systems
8. **IEEE Std 929-1988** - IEEE recommended practice for utility interface of residential and intermediate photovoltaic (PV) systems (Note: 929-2000 Administratively withdrawn February 3, 2006)
9. **IEEE Std C37.90-2005** - IEEE Standard for Relays and Relay Systems Associated with Electric Power Apparatus
10. **IEEE Std C37.90.1-2002** - IEEE Standard for Surge Withstand Capability (SWC) Tests for Relays and Relay Systems Associated with Electric Power Apparatus
11. **IEEE Std C37.90.2-2004** - IEEE Standard for Withstand Capability of Relay Systems to Radiated Electromagnetic Interference from Transceivers
12. **IEEE Std C37.90.3-2001** - IEEE standard electrostatic discharge tests for protective relays (Reaffirmed 2006)
13. **IEEE Std C57.13-2008** - IEEE Standard Requirements for Instrument Transformers
14. **IEEE Std C57.13.1-2006** - IEEE Guide for Field Testing of Relaying Current Transformers
15. **IEEE Std C57.13.2-2005** - IEEE Standard Conformance Test Procedures for Instrument Transformers

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16. **IEEE Std 1159-2009** - IEEE Recommended Practice for Monitoring Electric Power Quality.
17. **IEEE Std 242-2001** - IEEE Recommended Practice for Protection and Coordination of Industrial and Commercial Power Systems - IEEE Buff Book – Correction Sheet Issued January 24, 2003 for tables 9-3b and 9-3c
18. **IEEE Std 1453-2004** - IEEE Recommended Practice for Measurement and Limits of Voltage Flicker on AC Power Systems
19. **IEEE Std 493-2007** - Gold Book - IEEE Recommended Practice for the Design of Reliable Industrial and Commercial Power Systems
20. **IEEE Std 1100-2005** - EMERALD BOOK - IEEE Recommended Practice for Powering and Grounding Electronic Equipment
21. **IEEE Std 1250-1995** - IEEE Guide for Service to Equipment Sensitive to Momentary Voltage Disturbances
22. **IEEE Std C37.1-2007** - IEEE Standard for SCADA & Automation Systems
23. **IEEE Std 80-2000** - Safety in AC Substation Grounding
24. **IEEE Std 81-1983** - Guide for Measuring Earth Resistivity, Ground Impedance, and Earth Surface Potentials of a Ground System Part 1: Normal Measurements
25. **IEEE Std C62.23-1995** - IEEE Application Guide for Surge Protection of Electric Generating Plants
26. **IEEE Std C57.12.00-2006** - IEEE Standard General Requirements for Liquid Immersed Distribution, Power and Regulating Transformers
27. **IEEE Std C57.13-2008** - IEEE Standard Requirements for Instrument Transformers
28. **IEEE Std C37.20.1-2002** - IEEE Standard for Metal-Enclosed Low-Voltage Power Circuit Breaker Switchgear (Reaffirmed 2007) – also see C37.20.1a-2005 and C37.20.1b-2006
29. **IEEE Std C37.20.2-1999** - IEEE Standard for Metal-Clad Switchgear
30. **IEEE Std C37.20.3-2001** - IEEE Standard for Metal-Enclosed Interrupter Switchgear
31. **IEEE Std C37.30-1997** - IEEE Standard Requirements for High Voltage Switches
32. **IEEE Std C62.41-1991** - IEEE Recommended Practice on Surge Voltages in Low-Voltage AC Power Circuits

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33. **IEEE Std C62.45-2002** - IEEE Recommended Practice on Surge Testing for Equipment Connected to Low-Voltage (1000V and Less) AC Power Circuits (Reaffirmed 2008)
34. **IEEE Std C37.010-1999** - IEEE Application Guide for AC High-Voltage Circuit Breakers Rated on a Symmetrical Current Basis (Reaffirmed 2005)
35. **CSA Std C22.1-2009** - Canadian Electrical Code, Part I
36. **CSA Std C22.2** - Canadian Electric Code Part II
37. **CSA Std C22.3** - Canadian Electric Code Part III (Electricity Distribution and Transmission Systems).
38. **CSA Std C22.3 No. 9-2008** - Interconnection of Distributed Resources and Electricity Supply Systems
39. **CSA Std C22.2 No. 107.1-01 (R2006)** – General Use Power Supplies
40. **CSA Std C22.2 No. 257-06** – Interconnecting Inverter-Based Micro-Distributed Resources to Distribution Systems
41. **CSA Std C22.2 No. 31-04 (R2009)** - Switchgear Assemblies
42. **CSA Std C22.2 No. 193-M1983 (R2009)** - High-Voltage Full-Load Interrupter Switches
43. **CSA Std C22.2 No. 0.2-93 (R2008)** - Insulation Coordination
44. **UL 1741** - Inverters, Converters, and Controllers and Interconnection System Equipment for Use with Distributed Energy Resources
45. **IEC TR3 61000-3-7 (Edition 2.0)** – Assessment of Emission Limits for the Connection of Fluctuating Installations to MV and HV Power Systems
46. **CAN/CSA-IEC 61215-08** – Crystalline silicon terrestrial photovoltaic (PV) modules – Design qualification and type approval
47. **CAN/CSA-CEI/IEC 61000-4-15-03 (R2007)** - Electromagnetic compatibility (EMC) — Part 4: Testing and measurement techniques — Flickermeter — Functional and Design Specifications
48. **CAN/CSA- C61400-12-1-07** - Wind Turbines—Part 12-1: Power Performance Measurements of Electricity Producing Wind Turbines
49. **NEMA CC 1-2009** – Electric Power Connection for Substations

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50. **NEMA LA 1-1992 (1999)** – Surge Arresters
51. **NEMA MG 1-2006 Rev 1-2007** – Motors and Generators
52. **ULC/ORD-C1703-01** – Flat-Plate Photovoltaic Modules and Panels
53. W. Xu, K. Mauch, and S. Martel. —An Assessment of the Islanding Detection Methods and Distributed Generation Islanding Issues for Canada, A report for CANMET Energy Technology Centre -Varenes, Nature Resources Canada, 65 pages.
54. Wilsun Xu, Guibin Zhang, Chun Li, Wencong Wang, Guangzhu Wang, Jacek Kliber, "A power line signaling based technique for anti-islanding protection of distributed generators: part I: scheme and analysis", *IEEE Trans. Power Delivery*, v22, n3, July 2007, pp. 1758 – 1766
55. Wencong Wang, Jacek Kliber, Guibin Zhang, Wilsun Xu, Blair Howell and Tony Palladino, —A Power Line Signaling Based Scheme for Anti-islanding Protection of Distributed Generators: Part II: Field Test Results, *IEEE Trans. Power Delivery* , v22, n3, July 2007, pp. 1767 – 1772.
56. W. Freitas, Z. Huang, W. Xu, —A practical method for assessing the effectiveness of vector surge relays for distributed generation applications, *IEEE Trans. Power Delivery*, v20, n1, pp. 57-63, Jan. 2005