



FortisAlberta Technical Interconnection Requirements for DER less than 150kW

DER-01

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The DER owner, employees or agents recognize that they are, at all times, solely responsible for the generator plant design, construction and operation.

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1. Scope

This document is prepared to assist DER owners understand their roles and responsibilities when connecting to the FAI electrical distribution system as a generator.

1.1. The requirements listed in this document apply to the following:

1.1.1. DER System less than or equal to 150kW

- Inverter based
 - A certified unit or a certified system of units
- Micro cogeneration combined heat & power (CHP) based
 - Less than 150kW

Note: CHP generation require submission of a FortisAlberta Interconnection protection settings (IPS) document.

1.1.2. Examples of such DER systems may include

- Residential solar
- Commercial solar
- Combined heat & power (CHP)

1.2. This document does NOT apply to the following:

- DER systems greater than 150kW

Note: For DER applications greater than 150kW, please refer to the document “DER-02 - FortisAlberta Technical Interconnection Requirements - DER 150kW and Greater” on the FortisAlberta’s [Website](#).

- Inverter based systems that are not certified either as a unit or a system of units
- Generators (Momentary Closed Transition) connecting momentarily (Parallel the distribution for 100 ms or less) through automatic transfer switches (such as back-up / standby generators).

Note: For “Momentary Closed Transition” applications, please refer to the document “Interconnection Requirement Checklist - Standby or Backup Generator” on the FortisAlberta’s [Website](#).

2. Normative References

2.1. Knowledge of the following documents are prerequisites for these interconnection requirements. The documents shall be understood and followed, especially when cited in this document.

2.2. Interconnection Standards

CSA C22.3 No. 9-08 (R2015) – Interconnection of distributed resources and electricity supply system

A major revision of this standard is expected to publish in 2018.

IEEE P1547-2018 – Standard for Interconnection and Interoperability of Distributed Energy Resources with Associated Electric Power Systems Interfaces

C22.1 No. 1-2018 - Canadian Electrical Code (CEC), Part 1

2.3. Equipment Standards

CSA C22.2 No. 107.1-16 – Power Conversion Equipment

UL 1741 (2018) – Standard for Inverters, Converters, Controllers and Interconnection System Equipment for Use with Distributed Energy Resources

UL 1741 Supplement A – Test methods for advanced inverter functions

2.4. Other Technical Standards

IEEE 519-2014 – Recommended Practice and Requirements for Harmonic Control in Electric Power Systems

IEEE 2030-2011 – Guide for Smart Grid Interoperability of Energy Technology and Information Technology Operation with the Electric Power System (EPS), and End-Use Applications and Loads

NISTIR 7628 (2010) – Guidelines for Smart Grid Cyber Security

3. Glossary

anti-islanding: a protective functionality aimed at preventing the continued existence of an unintentional electrical island (see “Islanding” below) to avoid safety concerns and potential damage to customer equipment.

backup or emergency generator: an independent reserve source of electric energy that, upon failure or outage of the normal source, automatically provides reliable electric power within a specified time to critical devices and equipment whose failure to operate satisfactorily would jeopardize the health and safety of personnel or result in damage to property.

certified: tested and approved and by an accredited certification organization such as CSA, UL, IEEE

cease to energize: cessation of active power delivery under steady-state and transient conditions and limitation of reactive power exchange.

distributed energy resource (DER): a source of electric power that is not directly connected to a bulk power system. DER includes both generators and energy storage technologies capable of exporting active power to an EPS. DER includes DG and MG.

distributed energy resource (DER) system: the DER Unit's, interconnection systems, control systems, sensing devices or functions, and protection devices or functions up to the point of the DER connection.

distributed energy resource (DER) unit: an individual DER device inside a group of DER that collectively form a system.

distributed generation (DG): power generators that are connected to a distribution system through a Point of Common Coupling (PCC).

distribution system: a system for distributing electricity, including any structures, equipment or other things used for that purpose. A distribution system is comprised of the main system capable of distributing electricity to many customers and the connection assets used to connect a customer to the main distribution system.

electric power system (EPS): facilities that deliver electric power to a load.

energize: active power outflow of the DER to an EPS under any conditions (e.g. steady state and transient)

FAI: FortisAlberta Inc.

flicker: a perceptible change in electric light source intensity due to a fluctuation of input voltage. (In the context of power supply disturbances, the term applies to perceptible, subjective, objectionable and random or periodic variations of the light output).

harmonics: sinusoidal voltages and currents at frequencies that are integral multiples of the fundamental power frequency which is 60 Hz in Alberta.

inverter: a machine, device, or system that changes direct-current power to alternating-current power

islanding: a condition in which a portion of a transmission and/or distribution system is energized solely by one or more DERs, while that portion is electrically separated from the rest of the transmission or distribution system.

micro generation (MG): a DER system which meets the requirements of the Alberta Energy Micro-Generation Regulation, Section 1(1)(h).

measurement point: the location where the interconnection performance requirements specified in this standard apply.

momentary closed transition: a DER which parallels to the distribution system for less than 100ms. See CSA C22.3 No 9-08 (7.4.13)

point of common coupling (PCC): the point of connection between the wires owner and the a DER facility.

point of connection (PoC): the point of connection to where a DER unit is connected to a DER system.

ride-through: ability to withstand voltage or frequency disturbances inside defined limits and to continue operating as specified

synchronization: the state and operation where the DG facility is connected to the distribution system and supplies loads along with the electric grid.

total harmonic distortion (THD): the ratio of the rms value of the sum of the squared individual harmonic amplitudes to the rms value of the fundamental frequency of a complex waveform.

wires owner: the entity who owns and/or operates a distribution system

4. Interconnection Requirements

4.1. Measurement Point

The measurement location is the location where the DER system measures power system quantities for the purpose of implementing the protection and control functions required by this Standard.

- **Under 150kW** – Measurement point may be between the point of common coupling (PCC) and the point of common coupling (PoC).

Note: conductor type, distance to service entrance, DER type and size are all required as a part of the SLD submitted with the application. This information will help to model and calculate issues concerning voltage rise which may need to be mitigated.

4.2. Isolating Device

All DER systems must follow the Canadian Electrical Code Part I and be capable of isolating from the distribution during maintenance and emergency conditions. (See Section 84 of CEC, Part I)

4.3. Interconnection Grounding

In accordance with CSA C22.3 No. 9-08, DG Systems must be grounded as per manufacturer's recommendations and CEC Part I. Transformer grounding systems shall be coordinated with FortisAlberta and shall not cause voltage disturbances or disrupt coordination of distribution system ground fault protection.

4.4. DER Unit Certification

For all individual inverter systems and multiple inverter systems:

- CSA C22.2 107.1 and UL 1741/SA certifications are required prior to energization.
- Only inverters which are certified may be connected to the distribution system.

4.5. Power Quality (Technical specifications and performance requirements)

I. **Voltage**

DER owner is responsible to manage the voltage/power control modes of the DER system to ensure compliance of FortisAlberta's system with the range specified in CSA C235. This applies to both primary voltage and secondary voltage where the concern is multiple customers off the same service transformer.

Note 1 – DER systems which are under 10kW may operate in any voltage control mode.

II. **Harmonic Distortion**

Harmonic current distortion must comply with the limits from CSA C22.3 No. 9. Current total harmonic distortion (THD) shall not exceed 5% of rated current.

III. **DC Current Injection**

The DC current injection must not exceed 0.5% of the full rated output current at the measurement point.

4.6. Reactive Power and Voltage/Power Control Requirements

DER systems shall be capable of sourcing (injecting, over-excited, capacitive) and consuming (absorbing, under-excited, inductive) reactive power, Q up to levels within the range of values as indicated below at all PCC feed-in active power, P levels from 20% of corresponding DER nameplate kVA rating and onward.

(Minimum DER System Reactive Power Capabilities)

- Sourcing (capacitive) and Consumption (inductive) Capability as % of as Nameplate Apparent Power, S (kVA) Rating
- 44% over +/- 5% of PCC nominal voltage range

Note: 44% is equivalent to a power factor range of ± 0.9 (i.e., 0.9 lagging and leading)

4.7. Technical Protection Requirements

4.7.1. Shall Trip Requirements

- All DER Units shall comply with the default shall trip requirements for category II as detailed in IEEE 1547-2018, unless otherwise stated in this document.

Voltage Trip Requirements (IEEE – 1547-2018 – Category II)		
Trip function	Default settings	
	Voltage (% of nominal voltage)	Clearing time (s)
OV2	120	0.16
OV1	110	2.0
UV1	70	2.0
UV2	45	0.16

Frequency Trip Requirements (IEEE – 1547-2018 – Category II)		
Trip function	Default settings	
	Frequency (Hz)	Clearing time (s)
OF2	62.0	0.16
OF1	61.2	300.0
UF1	58.5	300
UF2	56.5	0.16

Note: Frequency trip requirements for generation over 150kW shall meet (WECC) requirements.

- All DER systems shall cease to energize and trip when a fault is detected on the distribution system.

4.7.2. Anti-Islanding

- Inverter based generation shall meet the anti-islanding requirements of CSA C22.2 No. 107.1 and UL 1741 SA
- All other forms of generation must cease to energize and trip within 2 seconds of the formation of an island.

4.7.3. Return to Service after Trip

After ceasing to energize the distribution system due to any abnormal condition, the DER system must wait 300 seconds before attempting to reconnect.

4.7.4. Synchronization

The synchronization or interconnection process for any DER system shall not create a voltage drop greater than 5% and shall, at the measurement point, meet the flicker requirements of CAN/CSA 61000-3-5 (Low Voltage) and CAN/CSA 61000-3-7 (Medium Voltage).

4.7.5. FortisAlberta Interconnection Protection Settings (IPS) Document

Non-Inverter generation requires the submission of a FortisAlberta IPS document. Please use the IPS document template on the FortisAlberta Website.

5. Control and Monitoring Requirements

- 5.1.1. DER Facility shall have the provision for monitoring the isolation device at the PoC.
- 5.1.2. A SCADA link and modem to FortisAlberta’s network is not required but may be requested at a later date.
- 5.1.3. Monitoring data requirements shall comply with IEEE 1547-2018 (Section 10) for all available data points. Minimum required data points which FortisAlberta may request are currently the following:

Minimum Required Data Points	
Active Power (W)	Reactive Power (Var)
Voltage (V)	Frequency (Hz)
Operational State (Generation On or Off, Operational Mode)	Connection Status
Alarm Status	Operational State of Charge (if applicable)

Note 1 – All DER monitoring requirements of IEEE 1547 must be available through a DER unit to make available for future monitoring and control.

6. Communication Requirements

The DER system shall be capable of providing real-time operating information to FortisAlberta from an intelligent electronic device (micro-processor relay, inverter, etc.). When deemed applicable by FortisAlberta, a communication interface module may be supplied by FortisAlberta for real-time control and/or monitoring.

Eligible Protocols (IEEE 1547)		
Protocol	Transport	Physical layer
IEEE Std 2030.5 (SEP2)	TCP/IP	Ethernet
IEEE Std 1815 (DNP3)	TCP/IP	Ethernet
SunSpec Modbus	TCP/IP	Ethernet
	N/A	RS-485