

Bulletin 84-1-18
Interconnection of electric power production sources
Rules 2-010, 2-024, 64-078, 64-110, 84-004, 84-008, 84-018, 84-022 and 84-030

Issued May 2023
Supersedes Bulletin 84-1-17

Scope

- 1) Requirements for power production sources
- 2) Single-phase inverters connected to three-phase system
- 3) Neutral conductor requirements for connection to a supply authority
- 4) Requirements for connection to a supply authority
- 5) Inverters approval

1) Requirements for power production sources

This bulletin applies to power production sources that are subject to inspection in accordance with the Ontario Electrical Safety Code (OESC). It is intended to provide additional information and clarification to the requirements of Section 84, “Interconnection of electric power production sources”.

Additional information can also be found in:

- 1) CSA standard C22.2 No. 257 Interconnecting inverter-based micro-distributed resource to distribution systems;
- 2) CSA standard C22.3 No. 9 Interconnection of distributed resources and electricity supply systems; and
- 3) ESA Bulletin 64-1-* “Connection of interactive inverters on the load side of service disconnecting means.”

General

Rule 84-002 requires that a supply authority be consulted as part of planning an interconnected power production sources.

Protection and Control

Protection and control of power production sources is required in accordance with Section 84.

For electrical power production sources installations utilizing inverter technology and directly connected to the supply authority, an inverter that is approved and marked “INTERACTIVE INVERTER” is acceptable as meeting the protection and control requirements of Section 84.

Where inverters are connected to the supply authority system through a customer-owned isolation transformer, the designer/installer shall provide proof to the area electrical inspector that the inverter will shut down upon loss of any one phase on the supply authority side of the isolation transformer, Rules 84-008 and 64-078. The secondary of the isolation transformer often continues to deliver similar operating

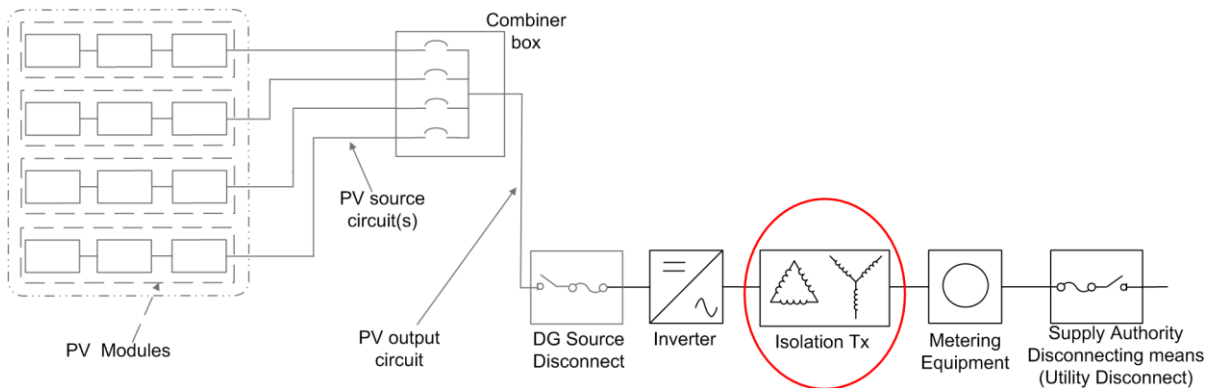
voltage in an open delta configuration. An example of one of the configurations where the inverter may not shut down upon loss of any one phase on the supply authority side is WYE-DELTA, with the delta facing the inverter, as shown in Diagram B1 (may not be limited to only that configuration).

Location for supply authority disconnecting means: Rule 84-022 requires disconnecting means to be provided to disconnect simultaneously all electrical power production sources from the supply authority system. As per Rule 84-024, the disconnecting means is required to be readily accessible for all types of interconnected power production sources in all buildings (residential, commercial, industrial, etc.)

- For single dwellings, the location of the supply authority disconnecting means is required to be mounted externally beside the meter.
- For installations in other than single dwellings, it has to be in a location acceptable to the supply authority.

Visible isolation may be required for some installations as per the supply authority. Installers are required to comply with the supply authority requirements for disconnecting means.

Diagram B1 – Solar PV system connected to a supply authority via an isolation transformer



The Electrical Safety Authority (ESA) strongly recommends designers of interconnected power production sources utilizing an isolation transformer consult with a transformer manufacturer and review the supply authority and customer configurations/requirements prior to specifying the transformer for a project.

For systems based on non-inverter technology or utilizing an approved stand-alone inverter, the protection and control required by Section 84 shall be coordinated with and acceptable to the supply authority, prior to connection authorization from ESA. The owner or owner’s agent shall provide verification to ESA that the installed protection and control is acceptable to the supply authority.

For this reason, the supply authority must be involved with customer-owned, electric power production installations.

Temporary connections may be authorized to permit calibration and coordination prior to generation.

Plan Review

Electrical work on any electrical installation shall not commence until plans have been submitted and examined by the ESA. Refer to bulletin 2-11-* for further information on this requirement.

2) Single-phase inverters connected to three-phase system

Question 1

Are one or two single-phase inverters marked as “INTERACTIVE INVERTER” permitted to be connected to a three-phase supply authority system?

Answer 1

Yes if permitted by the supply authority and meet the conditions of Rule 64-110.

3) Neutral conductor requirements for connection to a supply authority

Question 2

For an electrical power production source (generator) connected to a supply authority incorporating a neutral (grounded circuit conductor), does the OESC require a neutral output from the generating system to be connected to the supply authority system neutral?

Answer 2

No, unless:

- The generator used requires a neutral reference from the supply authority (Rule 2-034); or
- The supply authority specifies a neutral output (Rule 84-002).

Question 3

Where a transformer is used to change the voltage of the electrical power production source to match that of the supply authority, does the OESC require transformer output to have a neutral point for connection to the supply authority system neutral? (i.e.: 208 V solar inverter system connected to 347/600 V supply authority.)

Answer 3

No, unless the supply authority requires a neutral output.

Rationale

Although the supply authority connected electrical power production source may also feed neutral connected loads within the facility, or load share, and a neutral connection to the revenue meter may also be required by the supply authority for metering purposes, the OESC does not mandate a neutral output.

Some supply authorities specify a neutral output from the interconnected electrical power production source which would require compliance based on Rule 84-002.

Some grid tie inverters require a neutral reference from the supply authority; this would require compliance based on Rule 2-034.

Some grid tie inverters can be configured to operate with or without a neutral output, (i.e. L1 and L2 only). Others, such as three-phase grid tie inverters, may require a neutral reference.

Supply authorities may also require a neutral output from the interconnected electrical power production source for metering purposes or for voltage stability.

4) Requirements for connection to a supply authority

Some products can operate in parallel with the supply authority and can be programmable whether or not to back-feed the supply authority. The applicable requirements for supply authority interconnection are required as per CSA standard C22.2 No. 107.1 and UL standard UL 1741. The interconnection requirements may be included in the certification of energy storage systems.

These products may not be, or do not include “transfer devices” that electrically isolate the system from the supply authority. Devices that operate in parallel with the supply authority are required to meet the applicable standards’ requirements for supply authority interconnection and be marked as “INTERACTIVE INVERTER” or equivalent.

Rule 84-002 requires the interconnection of electrical power production sources, with or without energy storage (such as batteries), to be in accordance with supply authority. As part of the business process at ESA, inspectors are required to send a connection authorization to the supply authority indicating interconnected electrical power production sources regardless if it is programed not to back-feed.

Examples of systems that may operate in parallel with the supply authority:

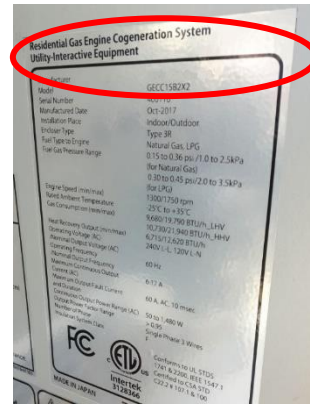
- 1) Self-contained energy storage systems, see Photos B1

Photo B1 - Example of self-contained energy storage system and nameplate



2) Residential co-generation systems, see Photos B2

Photo B2 - Example of residential co-generation system and nameplate label



Supply authority interconnected installations are required to meet all Section 84 requirements including

- Installation of a disconnecting means (Rule 84-022);
- Installation of a warning notice that indicate more than one source and diagram of the interconnected system (Rule 84-030).

5) Inverters approval

Background

Since October 2020, ESA has been accepting inverters certified to UL 1741 SA or SB standard (2016 or any subsequent revisions) marked as “Grid support utility interactive inverter” or equivalent, if a supply authority requires the grid support function. Grid support inverters are inverters whose AC output is intended for use in parallel with an electricity supply authority network, whether the inverter injects net power into the supply network or not, and helps support system stability.

CSA standard for inverters, C22.2 No. 107.1, has been updated in 2021 to reference CSA standard C22.3 No.9 for grid interconnection requirements.

Interactive inverters with grid support function, certified to CSA standard are required to be marked as:

“Grid Support Interactive Inverter – CSA C22.3 No. 9 - Basic” or

“Grid Support Interactive Inverter – CSA C22.3 No. 9 - Supplemental”

Direction

Starting October 1st, 2023, ESA will no longer accept inverters certified to UL 1741 SA or SB standard (2016 or any subsequent revisions) marked as “Grid support utility interactive inverter” or equivalent. All inverters, including those with grid support function are required to be approved to CSA standard for inverters, C22.2 No.107.1.

To summarize inverters' approval requirements and marking:

<u>Currently accepted (approval and markings)</u>	<u>After October 1st, 2023 (approval and markings)</u>
<u>All inverters</u>	
<p><u>Certified to: CSA C22.2 No. 107.1 and marked</u></p> <ul style="list-style-type: none"> • <u>“Interactive”, “utility interactive”, or equivalent: or</u> • <u>“Grid Support Interactive Inverter – CSA C22.3 No. 9 – Basic”, or</u> • <u>“Grid Support Interactive Inverter – CSA C22.3 No.9 – Supplemental”</u> 	<p><u>No change</u></p>
<u>When the supply authority requires grid support</u>	
<p><u>Certified to: CSA C22.2 No. 107.1 and marked</u></p> <ul style="list-style-type: none"> • <u>“Grid Support Interactive Inverter – CSA C22.3 No. 9 – Basic”, or</u> • <u>“Grid Support Interactive Inverter – CSA C22.3 No.9 – Supplemental”</u> <p><u>In addition, permitted to be certified to: UL 1741 SA or SB Standard (2016 or any subsequent rev.) and marked “Grid Support Interactive Inverter”</u></p>	<p><u>UL standard UL1741 SA or SB Standard will no longer be accepted</u></p>

Note: “Grid support inverters” are still required to meet the applicable interconnection requirements specified in Section 84.