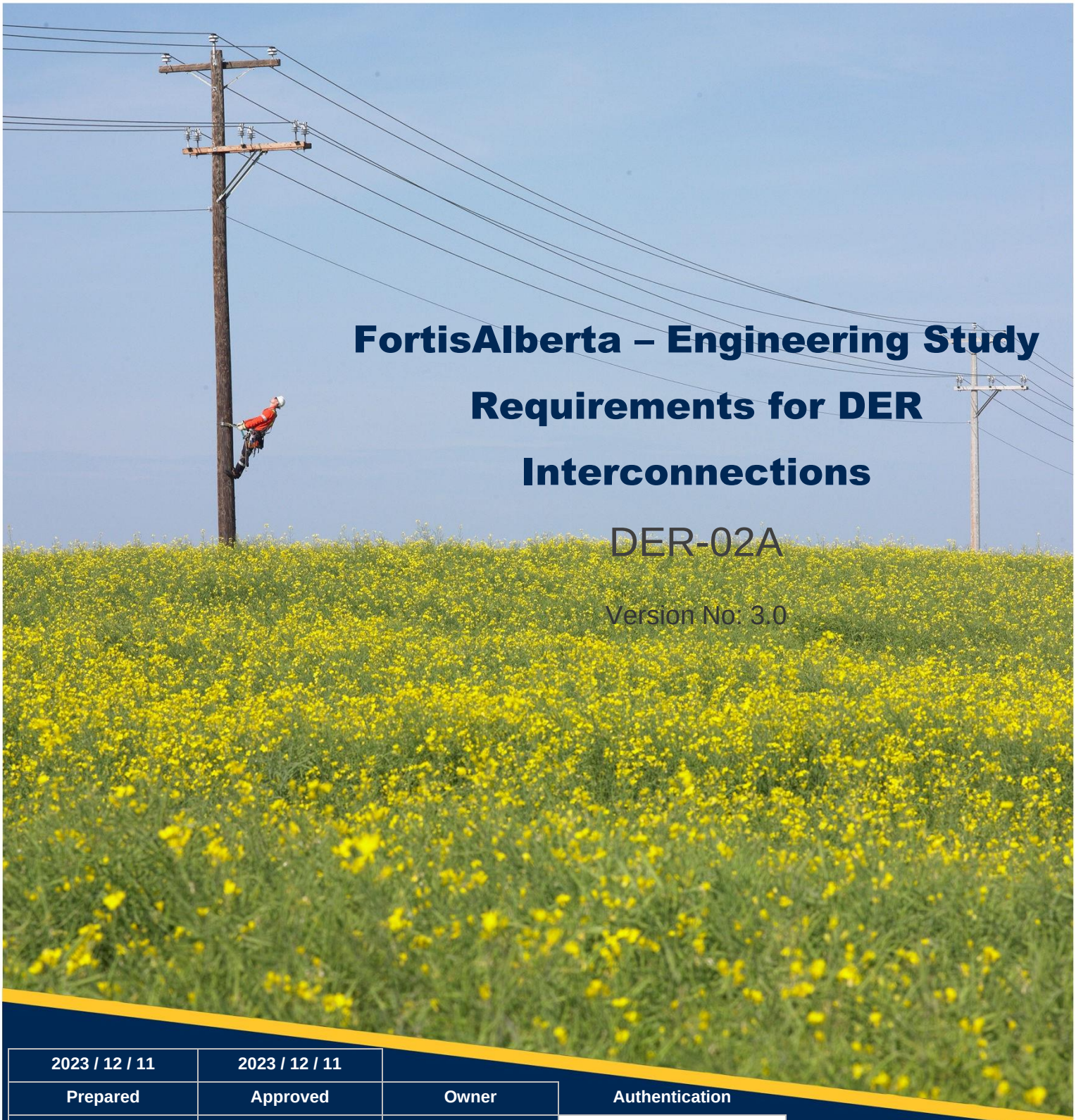

# FortisAlberta – Engineering Study Requirements for DER Interconnections

## DER-02A

Version No: 3.0

| 2023 / 12 / 11 | 2023 / 12 / 11 | | |
|---|---|---|---|
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**Validation**

**APEGA PERMIT NUMBER: P07387**

Responsible Member (RM) to sign and date authenticated original file

RM Name: Michael Simone

RM Signature: _____

Date: _____

FORTIS ALBERTA

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This document is not intended or provided as a design specification or as an instruction manual.

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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**Revision History**

| Version | Date | Revision Details |
|---|---|---|
| 3.0 | 11 Dec 2023 | Transformer inrush study changed to transformer inrush/RVC study |
| 2.0 | 17 March 2023 | Transformer inrush study added |
| 1.0 | 1 October 2021 | New Standard Issued |

# PURPOSE

This document is to serve as an aid for completing engineering studies for DER facilities and assess any additional technical requirements required to meet DER-02, including but not limited to grounding transformers, NGR's, and direct transfer trips.

## 1.0 Resources

The following documents should be understood for the purposes of reviewing DER grounding studies.

- DER-02 – FortisAlberta Technical Interconnection Requirements
- DER-02B – FortisAlberta Effective Grounding Study Requirements for DER Interconnections
- AESO DER Roadmap Integration Paper – DER Anti-islanding Screening and Study Guideline

## 2.0 Review Methodology

This section is to serve as a guide to determine anticipated impacts to the distribution system. These impacts are largely driven by the type and size of the DER facility, the minimum load of the feeder or protective segment, and the configuration of the DER interconnection transformer.

The 4 main studies required for DER Interconnections are the following.

- Short Circuit Study
- Effective Grounding Study (See DER-02B)
- Self-Excitation Study (If Applicable)
- Anti-Islanding Study (Transmission, If Applicable)

## SHORT CIRCUIT ANALYSIS

Short Circuit studies are broken into two submissions and are required to determine the initial equipment requirements of the DER facility and a final study after a project gets accepted.

It is required for all projects with a nameplate rating over 500kW.

**Preliminary Study (Required after the Detailed Level Study (DLS) Application)**

- Short Circuit Study
  - This study shall determine the line to ground (LG), three-phase to ground (LLLG/LLL) short circuit and the negative sequence current ($3I_0$) impacts, and mitigation required to the distribution system.
  - FortisAlberta will provide a system SLD at the detailed level study phase which will be required to complete the study and technical details of the DLS application.

*Requirements for the Study:*

- Demonstrate the DER system will not exceed the short circuit ratings of 5kA / 8kA on the distribution system (At both the DER facility PCC and Substation Bus)
- Demonstrate any zero-sequence current sourced by the DER facility shall not cause relay desensitization issues for any upstream protective devices by more than 10%. (Required for the effective grounding study; refer to DER-02B for additional details)

**Final Study (Required in the 110-day package)**

- Short Circuit Study
  - Complete all requirements listed in the preliminary study requirements with final equipment and DER facility parameters.
  - Fault detection and performance of the following fault conditions and locations:
    1. LG / LLLG faults at the DER facility (PCC), any upstream protective device on the distribution system, and the substation 25 kV and 138 kV bus. (Further upstream protective zones may be required if determined by the transmission owner)

## EFFECTIVE GROUNDING STUDY

This study demonstrates the DER facility is effectively grounded and complies with the performance and power quality requirements outlined in DER-02. A preliminary study is required at the DLS application phase and a complete study in the 110-day package.

It is required for all projects with a nameplate rating over 500 kW unless otherwise specified by FortisAlberta.

Note: The generation to load ratio of the DER facility will determine the complexity of the study.

**Please refer to the DER-02B document for the complete requirements.**

The preliminary study shall include an outline of the strategy that will be employed by the facility (e.g., supplemental grounding or inverter fast trip) to ensure the facility is effectively grounded and does not cause any relay desensitization issues. In addition, any proposed supplemental grounding devices with estimated sizes will be given on a P.Eng. authenticated preliminary single line diagram.

## SELF-EXCITATION STUDY (INDUCTION GENERATION)

DER facilities with induction generators and where a transfer trip is not required shall demonstrate there will be no possibility of self-excitation.

This is required for induction generators under 1 MW where a DTT is not required.

## TRANSMISSION ANTI-ISLANDING STUDY (IF APPLICABLE)

An anti-islanding study may be required by AESO or the transmission facility owner to determine if there are any impacts or concerns of islanding to the transmission system.

This study is required for all projects over 5 MW or where there may be generation onto the transmission system. Both the TFO and FortisAlberta will provide required data to complete any study.

**Please refer to the "AESO DER Roadmap Integration Paper –DER Anti-islanding Screening and Study Guideline" document for further guidance.**

### Study Timeframe

| Study Timeframe | | | | | |
|---|---|---|---|---|---|
| Required Stage | Short Circuit | Effective Grounding | Self-Excitation | Anti-Islanding | Transformer Inrush/RVC |
| DLS Application | Yes (Preliminary) | Yes (Preliminary) | No | Yes Required during the detailed level study design | Yes (Preliminary) |
| 110-Day Package | Yes (Final) | Yes (Final) | Yes (If applicable) | No | Yes (Final) |

Note: The preliminary studies require a FortisAlberta system SLD to be completed. To accommodate this, approximate parameters for supplemental grounding devices will not be required initially. Once

the FortisAlberta system SLD has been provided, the DER owner shall update their SLD with approximate parameters following the completion of a preliminary effective grounding study. Once the updated SLD is complete, the FortisAlberta DLS will be completed. The DLS stage will remain on hold until this information is provided.

### TRANSFORMER INRUSH/RAPID VOLTAGE CHANGE (RVC) STUDY

Any DER interconnection that has a total transformer capacity (sum of the capacities of all the transformers) greater than 400 kVA shall demonstrate compliance of RVC limits as per DER-02 through a transformer inrush/RVC study.

For site that energize interconnection transformers with or without generation a transformer inrush study is required to demonstrate compliance within RVC limits specified by DER-02.

For sites that energize in a composite manner (generation coupled with load) or generation only, a RVC study is required to demonstrate compliance within RVC limits specified by DER-02.

Minimum study requirements:

- Provide a SLD of the system under study, clearly indicate system data, transformer sizes, number of transformers, and any load or other passive devices under consideration.
- Transformer data including excitation curve details.
- Study methodology, assumptions (e.g., residual flux), and summary of study scenarios.
- Provide a typical (most likely) and worst-case scenario of single transformer energization RVC.
- Provide a typical RVC result for energization of all transformers at once.
- Upon receiving the Factory Acceptance Testing (FAT) reports for the transformers, study should be updated with the actual data along with FAT reports as attachments.

For facilities that require mitigation, the study shall include a demonstration of compliance through use of the measures, switching, and actual facility operations philosophies.

## 3.0 Approval / Sign-off

All engineering studies shall be submitted to FAI for review and approval within the timeframe in Table 1 and shall be authenticated by a professional engineer accredited to APEGA.