

IEEE Guide for Solar Power Plant Grounding for Personal Protection

IEEE Power and Energy Society

Developed by the
Energy Development & Power Generation Committee

IEEE Std. 778™-2020

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**Energy Development & Power Generation Committee
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Approved 30 January 2020

IEEE SA Standards Board

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Abstract: This guide is primarily concerned with the grounding system design for photovoltaic solar power plants that are utility owned and/or utility scale (5 MW or greater). The focus of the guide is on differences in practices from substation grounding as provided in IEEE Std 80. This guide is not intended for the substations to interconnect the plant; however, if the substation is included within the plant, portions of this guide may be applicable. Similarly, this guide does not directly cover small scale solar power plants (such as rooftop type systems), substation grounding, or lightning protection.

Keywords: grounding, IEEE 2778™, personnel, photovoltaic, protection, solar power plant

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Introduction

This introduction is not part of IEEE Std 2778-2020, IEEE Guide for Solar Power Plant Grounding for Personnel Protection.

Utility scale solar power plants (SPP) cover areas as large as tens of square kilometers. The approaches presented in IEEE Std 80^{TM1} for substations do not always directly apply to these much larger facilities. For example, in the United States, the National Electrical Code (NEC) [B5]² specifically excludes plants 5 MW and greater and the NESC (IEEE Std C2) [B1] does not provide significant guidance for plant design, primarily referencing IEEE Std 80. IEEE Std 80 is intended for substation environments where ground systems are comparatively small and have dense grid spacing in comparison to the grounding of utility scale SPPs.

This guide was prepared in order to help utilities, developers, and SPP operators understand the differences and challenges of utility scale SPP grounding. It heavily references IEEE Std 80 and IEEE Std 81TM in design, testing, and theory of grounding, focusing on the differences from these documents.

¹Information on references can be found in [Clause 2](#).

²The numbers in brackets correspond to those of the bibliography in [Annex A](#).

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IEEE Guide for Solar Power Plant Grounding for Personnel Protection

1. Overview

1.1 Scope

This guide is primarily concerned with the grounding system design for ground-mount photovoltaic (PV) solar power plants (SPPs) that are utility owned and/or utility scale (5 MW or greater). The focus of the guide is on differences in practices from substation grounding as provided in IEEE Std 80.

This guide is not intended for the substations to interconnect the solar plant; however, if the substation is included within the plant, portions of this guide may be applicable. Similarly, this guide does not directly cover small-scale SPPs (such as rooftop type systems), substation grounding, or lightning protection.

1.2 Purpose

The intent of this guide is to provide guidance and information pertinent to the grounding practices in SPPs for personnel protection, specifically to identify differences between substation grounding (covered under IEEE Std 80) and SPPs.

This guide is primarily concerned with grounding practices related to personnel protection within SPPs for 50 Hz or 60 Hz systems.

2. Normative references

The following referenced documents are indispensable for the application of this document (i.e., they must be understood and used, so each referenced document is cited in text and its relationship to this document is explained). For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments or corrigenda) applies.

IEEE Std 80™, IEEE Guide for Safety in AC Substation Grounding.

IEEE Std 81™, IEEE Guide for Measuring Earth Resistivity, Ground Impedance, and Earth Surface Potentials of a Grounding System.