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IEEE Recommended Practice for the Design of DC Power Systems for Stationary Applications

IEEE Power and Energy Society

Developed by the
Energy Storage and Stationary Battery Committee

IEEE Std 946™-2020
(Revision of
IEEE Std 946-2004)

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IEEE Recommended Practice for the Design of DC Power Systems for Stationary Applications

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Energy Storage and Stationary Battery Committee
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IEEE Power and Energy Society

Approved 30 January 2020

IEEE-SA Standards Board

Abstract: Recommended practices for the design of dc power systems for stationary applications are provided in this document. The components of the dc power system addressed by this document include lead-acid and nickel-cadmium storage batteries, static battery chargers, and distribution equipment. Guidance in selecting the quantity and types of equipment, the equipment ratings, interconnections, instrumentation and protection is also provided. This recommendation is applicable for power generation, substation, and telecommunication applications.

Keywords: auxiliary, backup, battery, battery charger, charger sizing, control, cross-tie, dc, direct current, distribution, duty cycle, generating station, ground detection, IEEE 946™, instrumentation, nuclear, panels, protection coordination, rectifiers, reserve, selective protection, short-circuit, substation, telecommunication

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The following members of the individual balloting committee voted on this recommended practice. Balloters may have voted for approval, disapproval, or abstention.

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Introduction

This introduction is not part of IEEE Std 946-2020, IEEE Recommended Practice for the Design of DC Power Systems for Stationary Applications.

DC power systems continue to play a vital role in generating station, substation, and telecom controls and providing backup for emergencies. This recommended practice fulfils a need within the industry to provide common or standard practices for the design of dc power systems. The design features are applicable to all installations and systems capacities.

The original issue of IEEE Std 946 was published in 1985 with the title IEEE Recommended Practice for the Design of Safety-Related DC Power Systems for Nuclear Power Generating Stations. The 1992 revision changed the title to apply to all generating stations, while including specific guidance and a detailed bibliography of nuclear design reference standards. This revision makes a general update to reflect the most recent industry practices as well as substantial additions to annexes. In addition to power generation applications, this recommended practice covers dc power system design in substations and telecommunication applications. Some discussions and illustrative figures have been retained as they offer a constructive comparison to designs without having to resort to additional standards.

This recommended practice was prepared by a Working Group that is part of the Energy Storage and Stationary Battery Committee and was sponsored by the Energy Development and Power Generation Committee of the IEEE Power and Energy Society.

Note that IEEE Std 1818™ and IEEE Std 946 are complementary documents, developed by independent working groups.[1]

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

Contents

IEEE Recommended Practice for the Design of DC Power Systems for Stationary Applications

1. Overview

1.1 Scope

This recommended practice provides guidance for the design of stationary dc power systems. The components of the stationary dc power system addressed by this recommended practice include the following:

- Storage batteries
- Static battery chargers/rectifiers (including sizing)
- Distribution equipment
- Protection equipment
- Control equipment
- Interconnections
- Instrumentation

Guidance for selecting the quantity, types, and ratings of equipment is also provided.

The considerations of each of these different components and the issue of load voltage and other load specifics are discussed in terms of their effect on the design of the whole system. Guidance on short-circuit calculation and contribution of different dc power system components is also offered to improve reliability, performance, and safety of the installation.

1.2 Purpose

The purpose of this document is to provide the user with information and recommendations concerning sizing and designing dc power systems in stationary applications.

While the recommended practices in this document apply to dc power systems in substations, additional guidance for substations is provided in IEEE Std 1818.[2]

[2]Information on references can be found in Clause 2.