

Chapter 1

Introduction

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1 – INTRODUCTION

Overview

The world is becoming more and more electricity-dependent. Electric power supplies are critical to almost any facility, and a reliable electric supply is vital to an increasing number of facilities. Facilities such as large office buildings and factories, as well as telecommunications installations, data centers, and Internet service providers are dependent on electric power that is available 24 hours a day, seven days a week with essentially no interruptions. This need is also fueled by the continuing proliferation of electronic computers in data processing, process control, life support systems, and global communications — all of which require a continuous, uninterrupted flow of electrical energy. Beyond reliability concerns, there are growing economic incentives favoring the installation of on-site engine-generator sets. As a result, engine-generator sets are routinely being specified for new building construction as well as for retrofits. They provide emergency power in the event of utility power failure and can be used to reduce the cost of electricity where the local utility rate structure and policy make that a viable option. Because of their important role, generator sets must be specified and applied in such a way as to provide reliable electrical power of the quality and capacity required.

Prime power electrical supplies, to both remote communities that are not served by a commercial electric power grid, and to those sites where the commercial power grid is for some reason not available for extended periods of time, are also becoming a requirement, rather than a luxury, to many users.

Whatever the use of the on-site power is intended to be, reliability of service from the on-site equipment, performance, and cost-effectiveness are primary concerns of users. The purpose of this manual is to provide guidance to system and facility designers in the selection of appropriate equipment for a specific facility, and the design of the facility, so that these common system needs are fulfilled.

About this Manual

This manual describes the specification and application of stationary, liquid-cooled, diesel and spark ignited engine-generator sets – referred to as “generator sets” in this manual. This manual consists of seven major sections: Preliminary Design, Electrical Load Impact on Generator Sizing, Equipment Selection, Electrical Design, Mechanical Design and Appendix.

Preliminary Design describes preliminary considerations for a generator set project. Equipment and installation requirements vary depending on the reasons for having the generator set and its intended use. When designing a generator set installation, reviewing and understanding these reasons is useful as a starting point for the system design and equipment choices.

Electrical Load Impact on Generator Sizing explains various load types, their characteristics and their impact on the generator set size, operation and equipment choices. Also covered is the topic of sequence of load connection.

Equipment Selection explains the fundamental parts of a generator set and related equipment, their functions and interrelationships, and criteria for choices. Functional characteristics, criteria for choices and optional equipment needed are discussed.

Electrical Design covers installation design of the generator and related electrical systems, their interface with the facility along with load and generator protection topics. The electrical design and planning of the on-site generation system is critical for proper system operation and reliability.

Mechanical Design covers installation design for the generator set and related mechanical systems along with their interface with the facility. The mechanical design and planning of the on-site generation system is critical for proper system operation and reliability. Topics include foundation and mounting, exhaust systems, cooling systems, ventilation, fuel systems, noise reduction, fire protection and equipment room.

The Appendix contains numerous useful topics including an overview of GenSize™ sizing software and the Power Suite contents. Also included are a discussion of reduced voltage motor starting and useful references to world voltages, maintenance concerns, formulas, Code and Standards references and a glossary of terms.

This manual describes the application of stationary gensets. This manual does not cover the application of stationary–designed commercial gensets into mobile applications, which are generally considered to be an unintended application. Cummins Power Generation (CPG) does not approve any mobile application of its commercial gensets except for those applications specifically designed and tested by CPG. If CPG's distributors or customers desire to apply stationary–designed commercial gensets into other mobile applications, then they should do so only after extensive analysis, testing, and clear communication with the end–use customer regarding possible limitations on the use or design life of the genset. CPG cannot ensure that the attributes of the product are the proper and sufficient ones for customers' mobile applications, therefore each customer must satisfy itself on that point. Each customer is responsible for the design and function of its own applications and installation.

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Related Application Manuals

Every generator set installation will require power transfer equipment, either transfer switch(es) or paralleling switchgear. The proper system for the job and its proper application are crucial to reliable and safe operation. The following Cummins Power Generation application manuals address related aspects of standby and emergency power systems. Because these manuals cover aspects requiring decisions that must be taken early in the design process, they should be reviewed along with this manual.

Application Manual T–011–Automatic Power Transfer Systems. Many applications utilize multiple power sources to enhance electric power system reliability. These often include both utility (mains) service and generator set service to critical loads. T–011 covers the various types of power transfer systems available, and considerations for their use and application. Careful consideration of power switching system at the start of a project will enable a designer to offer the most economically viable and most reliable service to the facility user.

Application Manual T–016–Paralleling and Paralleling Switch Gear. Paralleling equipment makes two or more generator sets perform as one large set. This can be economically advantageous, especially when the total load is greater than 1000 kW. The decision whether to parallel sets must be made in the early stages of design, especially if space and the need for future expansion are critical factors.

Safety

Safety should be a primary concern of the facility design engineer. Safety involves two aspects: safe operation of the generator set itself (and its accessories) and reliable operation of the system. Reliable operation of the system is related to safety because equipment affecting life and health is often dependent on the generator set – such as hospital life–support systems, emergency egress lighting, building ventilators, elevators, fire pumps, security and communications.

Refer to the Technical Reference section for information on applicable electrical and fire codes for North America, Central America and Europe. Standards, and the codes that reference them, are periodically updated, requiring continual review. Compliance with all applicable codes is the responsibility of the facility design engineer. For example, some

areas may require a certificate-of-need, zoning permit, building permit or other site-specific certificate. Be sure to check with all local governmental authorities early in the planning process.

NOTE: While the information in this and related manuals is intended to be accurate and useful, there is no substitute for the judgment of a skilled, experienced facility design professional. Each end user must determine whether the selected generator set and emergency/standby system is proper for the application.