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IEEE/ASHRAE Guide for the Ventilation and Thermal Management of Batteries for Stationary Applications

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Energy Storage and Stationary Battery Committee
of the
IEEE Power and Energy Society

and

ASHRAE
Guideline Project Committee 21 (GPC 21)

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Abstract: Vented lead-acid (VLA), valve-regulated lead-acid (VRLA), and nickel-cadmium (Ni-Cd) stationary battery installations are discussed in this guide, written to serve as a bridge between the electrical designer and the heating, ventilation, and air-conditioning (HVAC) designer. Ventilation of stationary battery installations is critical to improving battery life while reducing the hazards associated with hydrogen production. This guide describes battery operating modes and the hazards associated with each. It provides the HVAC designer with the information to provide a cost effective ventilation solution.

Keywords: ASHRAE Guideline 21, battery, battery cabinets, battery gassing, battery room, battery vaults, forced ventilation, hydrogen, IEEE 1635™, natural ventilation, stationary battery, thermal management, ventilation, ventilation system maintenance

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Introduction

This introduction is not part of IEEE Std 1635-2018/ASHRAE Guideline 21, IEEE/ASHRAE Guide for the Ventilation and Thermal Management of Batteries for Stationary Applications.

The primary purpose of this guide is to assist users involved in the design and management of new stationary lead-acid, valve-regulated lead-acid, and nickel-cadmium battery installations. The focus is the environmental design and management of the installation, to improve create a safe workplace and to maximize battery reliability as well as the safety of personnel and equipment. This guide is a joint effort by the IEEE and ASHRAE.

IEEE Std 1635/ASHRAE Guideline 21-2012 was first published in 2012. Per IEEE bylaws, a Sponsor and Working Group can conduct the revision of a standard at any time. A revision prior to year 10 will keep the standard continuously active for another 10-year period after the approval of the revision by the IEEE-SASB. The joint IEEE and ASHRAE working groups identified technical errors and omissions in the first edition that they felt could not wait until the next cycle. These included the following:

- Revised some formulae in A.2. Increased gassing equations for vented high-rate lead-acid batteries by as much as three times due to an oversight in the reference document
- Revised Table 1, Table 2, and Table 5. Gassing rates for vented high-rate lead-acid batteries were revised higher (by as much as three times) and added variations in design of nickel-cadmium cells
- Added new text for battery ratings in 7.2.2.4 for “high rate” batteries
- Reformatted and revised 7.2.4 for clarity and incorporated 7.2.7
- Deleted 7.2.7 and incorporated it into 7.2.4
- Subclause 7.2.6 was revised for clarity
- Revised Table 4 and Table 6 to add variations in design of nickel-cadmium cells
- Updated Equation (8) and Equation (9)
- Added text to A.6.1 regarding nickel-cadmium cells
- Added A.6.2, A.6.3, and A.6.4 for nickel-cadmium cells
- Revised B.2.3.1.2, to B.2.3.3, to B.2.3.4, and to B.2.3.1.5 to address variations in design of nickel-cadmium cells
- Annex C added several updates to reflect changing requirements in codes related to battery room ventilation
- Annex F was folded into Annex D
- Annex G was added to instruct in how to read battery data sheets, with examples of various battery types
- Bibliography was moved to Annex H
- Editorial changes are incorporated (most were paragraph numbering changes, reference changes, or grammatical changes)

Contents

IEEE/ASHRAE Guide for the Ventilation and Thermal Management of Batteries for Stationary Applications

1. Overview

1.1 Scope

This guide discusses the ventilation and thermal management of stationary battery systems as applied to the following:

- Vented (flooded) lead-acid (VLA)
- Valve-regulated lead-acid (VRLA)
- Nickel-cadmium (Ni-Cd)
- Partially recombinant nickel-cadmium

For each category, both the technology and the design of the battery are described in order to facilitate user understanding of the environmental issues associated with each type of technology.

The scope of this document includes only stationary batteries under conditions of expected use. Multiple operating modes are identified.

The ventilation practices described in this guide represent the “best practice” based on the information available at the time this document was developed. The user should evaluate these practices against their operating experience, operating conditions, number and size of battery systems, manufacturer’s recommendations, resources, and needs in developing an environment that is conducive to safety and optimum operation of the equipment. These recommendations were developed without consideration of economics, availability of equipment and personnel, or relative importance of the application. Design of a ventilation system for a specific battery installation requires consideration of all issues, not just the technical issues considered in this document.

1.2 Purpose

The purpose of this document is to provide heating, ventilation, and air conditioning (HVAC) and battery system designers and users with information and recommendations concerning the ventilation and thermal management of stationary battery installations.