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Emergency Communications Audio Intelligibility Applications Guide

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Foreword

Emergency voice communications are extensively used to provide building occupants information and instructions during emergencies. These messages contain vital safety information that must be clearly understood by the building occupants. Consequently intelligibility of these paging systems has become a vital concern. This guide was developed to assist specifiers and Jurisdictional Authorities that are not experts in Acoustics understand the basic concepts that impact intelligibility.

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Scope

NEMA has created this guide to assist specifiers and Authorities Having Jurisdiction understand the concepts and terminology utilized to enhance intelligibility for emergency voice paging systems. This is not nor is it intended to be a comprehensive treatment of the subject matter. Rather, it provides an overview of issues and general recommendations to enhance intelligibility.

Acknowledgement

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Section 1 Speech Intelligibility Overview

1.1 INTRODUCTION

Intelligibility – The capability of being understood or comprehended.

In simple terms, intelligibility is an evaluation of changes that occur to speech that impact comprehension. More specifically, intelligibility is concerned with evaluating reductions of the modulations of speech that cause undesired reductions in speech comprehension. These modulation reductions can also be thought of as a degradation of signal (speech) to noise ratio.

Over the last few years, the drive towards intelligible Emergency Voice/Alarm Communications Systems has been gaining momentum throughout the fire alarm industry. NFPA 72 *The National Fire Alarm and Signaling Code*[®] now requires that emergency voice/alarm communications systems be capable of producing messages with voice intelligibility and discusses methods for verifying intelligibility.

In the past, the fire alarm industry primarily focused concern on audibility requirements, assuming that if the sound was loud enough it would be sufficiently intelligible. Furthermore, many designs did not take into account ongoing changes in the construction of the building, the construction materials used in a building, or its furnishings. It is possible that many emergency voice/alarm communications systems designed under those conditions do not provide sufficiently intelligible communications. While those systems may provide highly audible alert and evacuation tones, speech information may not be properly delivered.

This guide provides general information on the concepts of intelligibility and on the design of emergency voice/alarm communications systems. It provides you with a better understanding of the factors affecting the intelligibility of these systems in public spaces and is intended to help design a system that meets the requirements for speech audibility and intelligibility in a cost effective manner.

1.1.1 Chapters of This Publication

This guide is separated into the following chapters:

- Chapter 1. Speech Intelligibility Overview: Provides an overview of audio intelligibility and an introduction to the topics covered in this publication.
- Chapter 2. Background Information: Provides several sections of background material that are essential to designing an intelligible system. Topics such as room acoustics, speaker design layouts, and audio math are discussed.
- Chapter 3. Speech Intelligibility: Details the influences and measurements of intelligibility.

1.2 IMPORTANCE OF AUDIBLE AND INTELLIGIBLE EMERGENCY COMMUNICATIONS

1.2.1 Speech Intelligibility Importance

Emergency voice/alarm communications systems are used in applications where it is necessary to communicate more detailed information to occupants of a building than the simple evacuation signal provided by horns or bells. For example, in a high-rise building, evacuation of all of the occupants at one time could create an unsafe situation in which the routes to evacuation could be blocked by the sheer number of people trying to exit at once.