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IEEE Std 844.4™-2019/CSA C293.4:19

IEEE/CSA Standard for Impedance Heating of Pipelines and Equipment—Application Guide for Design, Installation, Testing, Commissioning, and Maintenance

IEEE Industry Applications Society

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IEEE/CSA Standard for Impedance Heating of Pipelines and Equipment—Application Guide for Design, Installation, Testing, Commissioning, and Maintenance

This document was developed under the Partner Standards Development Organization cooperation agreement between IEEE and CSA Group and is submitted to a parallel enquiry vote by both organizations.

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IEEE-SA Standards Board

Abstract: An application guide for the design, installation, testing, commissioning, and maintenance of impedance heating systems for pipelines and equipment intended for use in general industrial applications is provided in this standard. This standard provides requirements when utilizing impedance heating systems in ordinary as well as hazardous areas having explosive atmospheres.

Keywords: heating systems, IEEE 844.4™, CSA C293.4, process heating, condensation prevention, freeze protection and temperature maintenance, re-melting solidified fluids, impedance heating, thermal insulation

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IEEE Introduction

This introduction is not part of IEEE Std 844.4-2019/CSA C293.4:19, IEEE/CSA Standard for Impedance Heating of Pipelines and Equipment—Application Guide for Design, Installation, Testing, Commissioning, and Maintenance.

Impedance heating systems have been used for a number of years in the industry. They were recognized for the first time in the 1981 issue of the National Electrical Code®, NFPA 70.[1]

Impedance heating of pipelines and equipment in petrochemical as well as other industries is a portion of total heating requirements.

This standard is a companion document to IEEE Std 844.3™/CSA C22.2 No. 293.3, IEEE/CSA Standard for Impedance Heating of Pipelines and Equipment—General, Testing, Marking, and Documentation Requirements.

Since impedance heating systems are interrelated with electric power, control, and alarm systems, other standards (some of which are listed in Clause 2) should be referred to when using this standard. This standard is not intended to supersede any current standards or recommended practices, and sound engineering judgment should always be used when applying this or any other standard.

This standard correlates industry practices; it is not intended to be a design guide or an exhaustive procedure manual. The annexes that are included in this standard are informative.

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CSA Preface

This is the first edition of IEEE Std 844.4™/CSA C293.4, IEEE/CSA Standard for Impedance Heating of Pipelines and Equipment—Application Guide for Design, Installation, Testing, Commissioning, and Maintenance, which is a harmonized standard jointly developed by IEEE and CSA Group. The IEEE requirements for impedance heating were previously published in IEEE Std 844.

This standard is one of five projects to break up the original IEEE Std 844 into separate requirements and application guidelines. This standard was developed under the Partner Standards Development Organization cooperation agreement between IEEE and CSA Group and was submitted to a parallel enquiry vote by both organizations.

Impedance heating systems have been used for a number of years in the industry. They were recognized for the first time in the 1981 edition of the National Electrical Code®, NFPA 70. Impedance heating of pipelines and equipment in petrochemical as well as other industries is a growing portion of total heating requirements.

This standard should be used in conjunction with IEEE Std 844.3™/CSA C22.2 No. 293.3, IEEE/CSA Standard for Impedance Heating of Pipelines and Equipment—General, Testing, Marking, and Documentation Requirements.

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This standard is not intended to supersede any current standards or recommended practices, and sound engineering judgment should always be used when applying this or any other standard. This standard correlates industry practices; it is not intended to be a design guide or an exhaustive procedure manual. The annexes that are included in this standard are informative.

This standard was reviewed for use in Canada by the CSA Integrated Committee on Trace Heating, under the jurisdiction of the CSA Technical Committee on Wiring Products and the CSA Strategic Steering Committee on Requirements for Electrical Safety, and has been formally approved by the CSA Technical Committee.

Interpretations: The Strategic Steering Committee on Requirements for Electrical Safety has provided the following direction for the interpretation of standards under its jurisdiction: "The literal text shall be used in judging compliance of products with the safety requirements of this standard. When the literal text cannot be applied to the product, such as for new materials or construction, and when a relevant CSA committee interpretation has not already been published, CSA Group's procedures for interpretation shall be followed to determine the intended safety principle."

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Contents

IEEE/CSA Standard for Impedance Heating of Pipelines and Equipment—Application Guide for Design, Installation, Testing, Commissioning, and Maintenance

1. Overview

1.1 General

This standard is divided into seven clauses. Clause 1 provides the scope and purpose. Clause 2 lists references to other standards that are useful in applying this standard. Clause 3 references definitions that are found in IEEE Std 844.3/CSA C22.2 No.293.3. Clause 4 establishes the design guidelines for impedance heating. Clause 5 provides installation considerations and guidelines. Clause 6 covers field testing, start-up, commissioning, and operation of impedance heating systems. Clause 7 provides maintenance and repair guidelines.

This standard also contains annexes. Annex A provides bibliographical references. Annex B provides pipe heat loss calculation methods. Annex C provides heat-up and cool-down calculation methods. Annex D provides a method to determine equivalent thicknesses of insulating cements. Annex E provides an example of design input parameters for an impedance heating design. Annex F presents an example of a record for installation requirements. Annex G shows an example of a form that can be used to document the commissioning of the system. Annex H presents an example of a preventive maintenance record. Annex I shows the insulated impedance conductor types covered in this standard.

1.2 Scope

This standard provides for the application of impedance heating systems for steel or steel alloy pipe and equipment. It provides recommendations for design, installation, maintenance, and repair of these systems in general industry applications.

This standard applies to impedance heating systems intended to be installed in ordinary and hazardous locations with explosive atmospheres. The hazardous locations include the following:

- In Canada: Zone 2; Zone 22; or Class I, Division 2; Class II, Division 2; Class III, Division 2 as described in CSA C22.1; and
- In the USA: Class I, Zone 2; Zone 22; or Class I, Division 2; Class II, Division 2; Class III, Division 2 as described in the NEC.

This standard, when used with other recognized codes and standards, is intended to cover impedance heating systems in their entirety, including system design, specification, installation, operation, testing, commissioning, and maintenance. This document also addresses the following associated systems that are important to the performance of impedance heating systems:

a) Thermal insulation systems;

b) Electric power supply systems;

c) Electric grounding systems; and

d) Control and monitoring systems.

1.3 Purpose

This standard is intended to aid the user in specifying, installing, operating, testing during commissioning, and maintaining impedance heating systems that:

a) Maintain design temperature;

b) Provide electrical, thermal, and mechanical durability and reliability; and

c) Reduce hazards to the user and the surroundings.

Design information, selection parameters, and data in this standard are not intended to provide a complete design primer for impedance heating systems. The information presented provides guidelines for the following:

— Selecting the optimum impedance heating system design;

— Establishing design criteria and constraints for the heated pipeline or equipment to help ensure system compatibility;

— Preparing specifications to obtain quotations for impedance heating systems; and

— Developing information on installation, operation, testing, commissioning, and maintenance of the impedance heating system.

1.4 Terminology

In this standard, “shall” is used to express a requirement, i.e., a provision that the user is obliged to satisfy in order to comply with the standard; “should” is used to express a recommendation or that which is advised but not required; and “may” is used to express an option or that which is permissible within the limits of the standard.

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