IEEE/CSA Standard for Skin Effect Trace Heating of Pipelines, Vessels, Equipment, and Structures—General, Testing, Marking, and Documentation Requirements

This document 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.

Sponsor

Petroleum and Chemical Industry Committee
of the
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IEEE-SA Standards Board

Abstract: General requirements, testing, markings, and documentation for skin effect trace heating systems for pipelines, vessels, equipment, and structures intended for use in general industrial applications are provided in this standard. This standard provides requirements when utilizing skin effect trace heating systems in ordinary as well as hazardous areas that have potentially explosive atmospheres.

Keywords: condensation prevention, CSA C22.2 No. 293.1, freeze protection and temperature maintenance, heating systems, IEEE 844.1, long line, process heating, re-melting solidified fluids, skin effect trace heating, structure heating, thermal insulation

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IEEE Introduction

This introduction is not part of IEEE Std 844.1-2017/CSA C22.2 No. 293.1-17, IEEE/CSA Standard for Skin Effect Trace Heating of Pipelines, Vessels, Equipment, and Structures—General, Testing, Marking, and Documentation Requirements.

This is the first publication of IEEE Std 844.1™/CSA C22.2 No. 293.1, Standard for Skin Effect Trace Heating of Pipelines, Vessels, Equipment, and Structures—General, Testing, Marking, and Documentation Requirements, which is a harmonized standard jointly developed by IEEE and CSA Group.

Skin effect trace heating systems have been used for a number of years in the industry. Skin effect trace heating of pipelines, vessels, equipment, and structures in petrochemical as well as other industries is a growing portion of total heating requirements because of its advantages in heating long pipelines with temperature control.

This standard should be used in conjunction with IEEE Std 844.2™/CSA C293.2, Standard for Skin Effect Trace Heating of Pipelines, Vessels, Equipment, and Structures—Application Guide for Design, Installation, Testing, Commissioning, and Maintenance.

Since skin effect trace 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.

CSA Preface

This is the first edition of IEEE Std 844.1™/CSA C22.2 No. 293.1, Standard for Skin Effect Trace Heating of Pipelines, Vessels, Equipment, and Structures—General, Testing, Marking, and Documentation Requirements, which is a harmonized Standard jointly developed by IEEE and CSA Group. It is one in a series of Standards issued by CSA Group under Part II of the Canadian Electrical Code.

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Since skin effect trace 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 considered suitable for use for conformity assessment within the stated scope of the Standard.

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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   d) Rationale for the change.

Contents

IEEE/CSA Standard for Skin Effect Trace Heating of Pipelines, Vessels, Equipment, and Structures—General, Testing, Marking, and Documentation Requirements

1. Overview

1.1 General

This standard is divided into seven clauses that cover requirements for skin effect trace heating when installed in ordinary locations as well as in hazardous (classified) locations. Clause 1 provides the scope, purpose, and typical applications. Clause 2 lists normative references to other standards that are indispensable in applying this standard. Clause 3 provides definitions that are either not found in other standards or have been modified for use with this standard. Clause 4 establishes general system requirements for skin effect trace heating. Clause 5 provides both type and routine testing requirements for skin effect insulated conductors and other skin effect system components. Clause 6 covers marking requirements. Clause 7 details additional documentation requirements.

This standard also contains annexes. Annex A provides bibliographical references. Annex B provides additional requirements for installations that are in explosive atmospheres classified using the Division method of area classification. Annex C provides additional requirements in explosive areas classified using the Zone method of area classification. Annex D covers skin effect trace heating design verification methodologies.

1.2 Scope

This standard applies to general, testing, marking, and documentation requirements for skin effect trace heating systems rated up to and including 5 kVac and 260 °C maximum skin effect insulated conductor temperature. These heating systems are intended for installation in accordance with the CSA C22.1, Canadian Electrical Code, Part I (CE Code); NFPA 70, National Electrical Code® (NEC®) in the USA; or with any other national electrical installation code, as applicable.[1]

This standard applies to skin effect trace heating systems intended to be installed in ordinary and hazardous locations. The hazardous locations include the following:

[1]National Electrical Code and NEC are both registered trademarks of the National Fire Protection Association, Inc.

— In Canada: Zone 1; Zone 2; Zone 21; Zone 22; or Class I, Division 2; Class II, Division 2; Class III, Division 2 as described in CSA C22.1.

— In the USA: Class I, Zone 1; Class I, Zone 2; Zone 21 and Zone 22; or Class I, Division 2; Class II, Division 2; Class III, Division 2 as described in the NEC.

This standard also applies to termination assemblies and control methods used with skin effect trace heating systems.

NOTE 1—Requirements for certification at voltages above 5 kVac or skin effect insulated conductor insulation temperatures above 260 °C may be considered under a special investigation by an accredited certification body.

NOTE 2—Information on transformer, power distribution, and controls components can be found in IEEE Std 844.2/CSA C293.2.[2]

1.3 Purpose

This standard provides testing, marking, design, and documentation requirements for skin effect trace heating systems. Skin effect heating systems are intended to

a) Maintain design temperature; and
b) Provide electrical, thermal, and mechanical durability and reliability

1.4 Typical applications

1.4.1 General

Skin effect trace heating systems provide heating for pipes, vessels, equipment, and structures in order to maintain or raise the temperature in the following typical applications.

1.4.2 Solidification prevention

Systems can be used to prevent the fluid in a line or a vessel from solidifying. These include water, aqueous solutions, crude oil, pitch, asphalt, metals, sulfur, and other chemicals. The heating system compensates for pipeline heat losses in order to maintain the temperature of the contents above the solidification point.

1.4.3 Viscosity maintenance

Systems can be used to maintain viscosity of a fluid in a pipeline or a vessel. Viscous materials such as heavy fuel and crude oil are generally heated to achieve optimum pump efficiency and pipeline sizes. Usually these materials are preheated to a temperature that provides the desired viscosity and pumped to their destination through heated pipelines designed to maintain that temperature.

1.4.4 Process heating

Systems can be used to maintain the temperature of fluids when process parameters require it. Systems can also be used to raise the temperature of process fluids flowing in the pipeline or the vessel, but they require increased heat input capacity.

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