

# IEEE Standard for Traction Power Rectifier Transformers for Substation Applications up to 1500 V DC Nominal Output

IEEE Vehicular Technology Society

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Rail Transportation Standards Committee

# IEEE Standard for Traction Power Rectifier Transformers for Substation Applications up to 1500 V DC Nominal Output

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**Rail Transportation Standards Committee  
of the  
IEEE Vehicular Technology Society**

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**IEEE-SA Standards Board**

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**Abstract:** Guidelines for establishing criteria for application, performance, interchangeability, tests, life cycle costs, and safety requirements of traction power rectifier transformers are established in this standard. Set forth are the electrical, mechanical and thermal design, manufacturing, and testing requirements for traction power rectifier transformers for dc electrification systems. Covered in this standard are liquid-immersed and dry-type transformers, including those with cast coil and epoxy resin encapsulated windings.

**Keywords:** basic lightning impulse insulation, BIL, commutating impedance, design optimization, electrical requirements, factory tests, ferroresonance, heavy rail, hot spot, IEEE 1653.1™, light rail, load cycle, overvoltage transient, partial discharge (PD) service conditions, tests, traction power duty cycle, traction power rectifier transformers, transit application

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## Introduction

This introduction is not part of IEEE Std 1653.1-2016, IEEE Standard for Traction Power Rectifier Transformers for Substation Applications up to 1500 V DC Nominal Output.

This is a new standard written specifically for transit industry applications, collecting requirements and references mainly from other existing IEEE transformer and testing standards, and other industry publications into one document. This standard is the result of an effort encompassing the interests of transit power authorities/owners, manufacturers, and others dedicated to producing voluntary consensus standards for traction power rectifier transformer technology.

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# IEEE Standard for Traction Power Rectifier Transformers for Substation Applications up to 1500 V DC Nominal Output

## 1. Overview

### 1.1 Scope

This standard covers design, manufacturing, and testing unique to the application of power rectifier transformers intended to operate in dc supplied transportation substation applications up to 1500 V dc nominal output.

### 1.2 Purpose

At the present time there are no suitable standards governing all requirements for traction power rectifier transformers. This standard will provide requirements specific to traction power transformers supplying power to dc supplied transportation equipment.

### 1.3 Mandatory requirements

In this document, the word *shall* is used to indicate a mandatory requirement. The word *should* is used to indicate a recommendation. The word *may* is used to indicate a permissible action. The word *can* is used for statements of possibility and capability.

## 2. Normative references

The following referenced documents are indispensable for the application of this document (i.e., they must be understood and used, so each referenced document is cited in text and its relationship to this document is explained). For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments or corrigenda) applies.

ASTM D2945-90(2003)e2, Standard Test Method for Gas content of Insulating Oils.<sup>1</sup>

IEC 60076-11, Dry-type transformers.<sup>2</sup>

<sup>1</sup>ASTM publications are available from the American Society for Testing and Materials, 100 Barr Harbor Drive, West Conshohocken, PA 19428-2959, USA (<http://www.astm.org/>).

<sup>2</sup>IEC publications are available from the International Electrotechnical Commission (<http://www.iec.ch/>). IEC publications are also available from the American National Standards Institute (<http://www.ansi.org/>).