

# IEEE Guide for Transformers Directly Connected to Generators

IEEE Power and Energy Society

Sponsored by the  
Transformers Committee

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**IEEE Std C57.116™-2014**  
(Revision of  
IEEE Std C57.116-1989)

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# **IEEE Guide for Transformers Directly Connected to Generators**

Sponsor

**Transformers Committee**  
of the  
**IEEE Power and Energy Society**

Approved 27 March 2014

**IEEE-SA Standards Board**

**Abstract:** Information on the selection and application considerations for the unit power transformer and unit auxiliaries power transformer is provided in this guide. Consideration is given to connections that include direct connection and connections through generator circuit breakers and load-break switches. The considerations referred to in this guide apply to hydroelectric and thermal electric generating stations. Various power transformer connections and possible operating problems under normal and abnormal conditions are treated. Phasing procedures, basic impulse insulation level selection, and loading practices are not covered.

**Keywords:** back-feed, electrical parameters, generator bus, IEEE C57.116™, load tap changing, overcurrent, overexcitation, transformer connections, transmission system, unit auxiliaries, unit power transformer

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## Introduction

This introduction is not part of IEEE Std C57.116™-2014, IEEE Guide for Transformers Directly Connected to Generators.

Transformers, directly connected to generators, experience excitation and short-circuit duties beyond those covered in other power transformer standards. Therefore, in 1979, the IEEE Transformers Committee decided that an application guide for such transformers was needed. In 1989, the IEEE Std C57.116 was approved and describes the selection, application, and specification considerations for the unit and unit auxiliaries transformers taking into account their connections, voltage and kilovolt ampere ratings; and excitation and through-fault capabilities during possible operating conditions, both normal and abnormal. Also included are load-tap changing and isolated phase-bus duct heating considerations. This guide does not address phasing procedures, basic impulse level selection, or loading practices.

In 2011, the IEEE Transformers Committee decided to revise this guide. Therefore, this guide is based on the latest knowledge, design, and application experience of the industry including:

- An updated Equation (1)
- New material on unit auxiliaries transformer faults and calculations
- Expanded guidance on use of isolated phase-bus
- A new clause on unit transformer operation in back-feed configuration
- A new bibliography
- General updates to match the current IEEE Style Manual

This standard is intended to provide guidance to application and specification engineers and therefore its use is strictly voluntary. Its use may become mandatory only when required by a duly constituted legal authority or when specified in a contractual relationship.

## Contents

1. Overview .....	1
1.1 Scope .....	1
1.2 Purpose .....	1
2. Normative references.....	2
3. Definitions .....	2
4. Background .....	3
5. Transformer connections .....	5
5.1 Unit transformer connections .....	5
5.2 Unit auxiliaries transformer connection.....	5
5.3 Unit transformer and unit auxiliaries transformer external connections .....	6
6. Selection of parameters of unit transformer .....	6
6.1 Generator bus electrical characteristics .....	6
6.2 Transmission system electrical characteristics .....	10
6.3 Evaluation of parameters for unit transformers .....	10
6.4 Summary of parameter selection .....	18
6.5 Spare, leased or alternative unit transformer .....	19
7. Selection of parameters of unit auxiliaries transformer .....	20
7.1 DETC voltage rating and tap range .....	21
7.2 Impedance.....	21
7.3 Megavoltampere rating.....	21
7.4 Phase relationship .....	21
7.5 Unit auxiliaries transformer loading.....	22
8. Transformer overcurrent considerations .....	22
8.1 Unit transformer faults.....	22
8.2 Unit auxiliaries transformer faults .....	22
8.3 Fast load transfer—mechanical considerations.....	25
9. Load tap changing considerations .....	29
9.1 Load tap changing equipment.....	29
9.2 Duty considerations .....	30
9.3 Specifications.....	30
10. Transformers with isolated phase-bus duct connections .....	30
11. UT transformers operated in back-feed configuration .....	31
11.1 Special transformer considerations.....	32
11.2 Protective relaying considerations .....	33
11.3 Surge protection considerations .....	34
Annex A (informative) Bibliography .....	35



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## 1. Overview

### 1.1 Scope

This guide describes selection and application considerations for the unit power transformer and unit auxiliaries power transformer. Consideration is given to connections that include direct connection and connections through generator circuit breakers and load-break switches. The considerations referred to in this guide apply to hydroelectric and thermal electric generating stations. Various power transformer connections and possible operating problems under normal and abnormal conditions are treated. Phasing procedures, basic impulse insulation level selection, and loading practices are not covered.

### 1.2 Purpose

The terminology, function, application, theory of operation and protection, and design of unit power transformers and unit auxiliaries power transformers are not covered by existing transformer standards and guides. The purpose of this document is to provide guidance for specifying, designing, and applying these types of power transformers.