



Technical Specification 48-3

Issue 2 2013

Instantaneous high-impedance differential
protection

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Foreword

This Technical Specification (TS) is published by the Energy Networks Association (ENA) and comes into effect from date of publication. It has been prepared under the authority of the ENA Engineering Policy and Standards Manager and has been approved for publication by the ENA Electricity Networks and Futures Group (ENFG). The approved abbreviated title of this engineering document is “ENA TS 48-3”.

This document cancels and replaces ENA TS 48-3 Issue 1.

This Standard specifies the performance of instantaneous high-impedance differential protective systems for most applications. It also states the conditions of acceptance of such protection on the basis of calculated performance in lieu of heavy current tests. Quick reference regarding the performance for any given application is given in 9.1, 9.2 and Table 1.

Unless stated otherwise, the r.m.s. value is implied for all currents and voltages referred to in this Standard.

Where the term “shall” or “must” is used in this document it means the provision is mandatory. The term “should” means the provision is a recommendation. The term “may” is used to express permission.

NOTE: Commentary, explanation and general informative material is presented in smaller type, and does not constitute a normative element.

1 Scope

This Standard covers the required performance and proving of instantaneous high-impedance differential protective systems as applied to synchronous machines, transformers, reactors, busbars and similar primary plant connections where bias is not required to cater for spill current (due for example to magnetizing inrush or tap changing). This Standard does not include the requirements of differential protection for induction motors, capacitors and other plant where special considerations may apply.

2 Normative references

The following referenced documents, in whole or part, are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

Standards publications

BS EN 61869-2, *Instrument transformers. Additional requirements for current transformers*

Protective Current Transformers and Circuits by P Matthews. *Published by Chapman & Hall Ltd (1955)*

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

3.1

assigned maximum through-fault current

current which would flow through the circuit concerned assuming:

- i. a specified maximum plant condition;
- ii. the generator reactances are the sub-transient values.

3.2

differential protection

protection in which the differential current equals the algebraic sum of the currents flowing into the protected zone

3.3

fault setting

minimum value of the primary current at which operation of the protective system occurs

3.4

high-impedance

characteristic of the protective relay circuit such that the relay performs as a voltage operated device as described in 6.1

NOTE: Typical high-impedance relay circuits are shown in Fig. 1.

3.5

knee-point e.m.f.

sinusoidal e.m.f. of rated frequency applied to the secondary terminals of the transformer, all other windings being open-circuited, which, when increased by 10 per cent, causes the exciting current to increase by 50 per cent