IEC 62505-3-1

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INTERNATIONAL STANDARD

NORME INTERNATIONALE

Railway applications – Fixed installations – Particular requirements for a.c. switchgear –
Part 3-1: Measurement, control and protection devices for specific use in a.c. traction systems – Application guide

Applications ferroviaires – Installations fixes – Exigences particulières pour appareillage à courant alternatif –
Partie 3-1: Dispositifs de mesure, de commande et de protection pour usage spécifique dans les systèmes de traction à courant alternatif – Guide d'application

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FOREWORD

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International Standard IEC 62505-3-1 has been prepared by IEC technical committee 9: Electrical equipment and systems for railways. This standard is based on EN 50152-3-1.

The text of this standard is based on the following documents:

FDIS	Report on voting
9/1221/FDIS	9/1234/RVD

Full information on the voting for the approval of this standard can be found in the report on voting indicated in the above table.

This publication has been drafted in accordance with the ISO/IEC Directives, Part 2.

A list of all parts of IEC 62505 series, under the general title *Railway applications – Fixed installations – Particular requirements for a.c. switchgear*, can be found on the IEC website.

The committee has decided that the contents of this publication will remain unchanged until the maintenance result date indicated on the IEC web site under "http://webstore.iec.ch" in the data related to the specific publication. At this date, the publication will be

- reconfirmed,
- withdrawn,
- replaced by a revised edition, or
- amended.

INTRODUCTION

IEC 62505-3 is divided as follows:

– Part 3-1: Application guide;
– Part 3-2: Single-phase current transformers;
– Part 3-3: Single-phase inductive voltage transformers.

This number of parts is subject to future additions as soon as a protection device is considered suitable for standard requirements.

Part 3-1 is a guide. Further parts are normative and apply when the equipment is concerned with the specified characteristics.

RAILWAY APPLICATIONS – FIXED INSTALLATIONS – PARTICULAR REQUIREMENTS FOR AC SWITCHGEAR –

Part 3-1: Measurement, control and protection devices for specific use in a.c. traction systems – Application guide

1 Scope

This part of IEC 62505 provides assistance, guidance and requirements in the design of protection, control and measuring systems in a.c. installations at traction voltages (see IEC 60850) intended to provide a power supply to traction systems. This application guide identifies the characteristics and parameters of equipment used in the measurement, control and protection of a.c. traction systems. Guidance is given in the correct use of protection.

2 Normative references

The following referenced documents 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.

IEC 62505 (all parts), *Railway applications – Fixed installations – Particular requirements for a.c. switchgear*

IEC 60850, *Railway applications – Supply voltages of traction systems*

3 Measurement

Two types of measurements are made:

a) measurement of current and voltage signals for connecting to instruments and telemetering;

b) measurement of current and voltage signals used for operating protection relays on over-current, low impedance, over/under-voltage and short circuit or distance protection.

The class, ratio and burden should be selected from the values in IEC 62505-3-2 or IEC 62505-3-3. The accuracy and purpose are dependant on the class selected.

4 Closing control systems

4.1 General

The application of the features described below depends on the philosophy of the user's control system.

Closing control systems are usually only those which involve the electrical closing of switchgear devices. Their effect is to permit or inhibit a closure depending on the status of the system (and plant) and the compliance of specified requirements.

4.2 Anti-pumping

This system limits the closing device to effect a single attempt while the signal to close is maintained. If the device fails to complete a satisfactory close operation whilst the close signal is maintained, then attempts at further reclosing (pumping) are inhibited.

An anti-pumping can be achieved in the closing control circuit in various ways, either by using circuit-breaker mechanism auxiliary switches or a timing relay. It only allows a single closing pulse to the closing device, which resets when the initial closing signal is released.

The purchaser should specify the need for anti-pumping feature.

4.3 Auto-reclose with variable reclose time and final lock out

Auto-reclose is only applied to line circuit-breakers and its purpose is to restore the system voltage to the overhead contact line automatically when there is a temporary loss of supply.

On traction systems a temporary loss of supply is not always due to permanent short circuits and an auto-reclose system can enhance the reliability of the system.

Auto-reclose is usually associated with a timing device which gives several attempts at reclosing with varying adjustable intervals of circuit dead time. After a prescribed number of unsuccessful recloses, then a lock out of the reclosing circuit should be instigated. The lock out relay may then be either electrically or manually reset.

The purchaser should specify the need for this requirement and the following information:

a) number of recloses: e.g. 2 recloses then lock out;

b) reclosing time intervals: e.g. 0,3 s, followed by 180 s, followed by 180 s (see 5.17 of IEC 62505-1);

c) lock out reset: i.e. local or remote.

4.4 Undervoltage close inhibit

When used and fitted to an incoming circuit-breaker on the secondary side of the traction transformer, the voltage signal is the voltage of the transformer. Unless the supply is available the circuit-breaker cannot be closed.

When fitted to a line circuit-breaker, the voltage signal is that of the busbar. Unless the busbar traction voltage is live, the line circuit-breaker cannot be closed.

The loss of the voltage signal should give an alarm or automatic tripping of all circuits connected thereto. This effect is achieved by undervoltage relays or other suitable voltage detecting devices with accurate pick up and drop off voltage levels, operating on to shunt trip devices and close inhibits.

The purchaser should specify the need for undervoltage close inhibit and the following information:

a) minimum pick up voltage kV;

b) maximum drop off voltage kV.

4.5 Line test device

Line test devices are used on line circuit-breakers before closing, to prevent the line circuit-breaker closing on to a short circuit.

This is achieved by inserting a resistor by means of a suitably rated switch or switch-disconnector between the switchboard busbar and the overhead contact line. The load impedance acts as a footing resistance to the inserted resistor and, by measuring the voltage

between feeder and return circuit, it can allow or inhibit a close signal. An example for a line test circuit is shown in Figure 1.

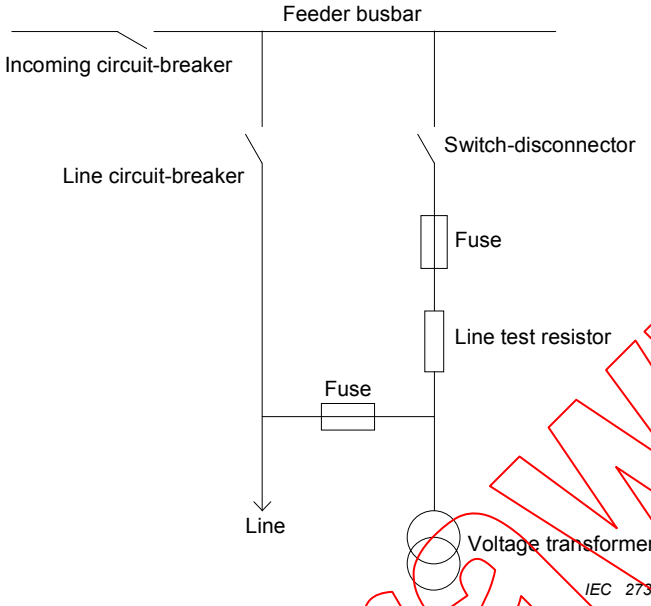

Figure 1 – Example for a line test device

When the measured voltage is low or below a prescribed level, when there is an overload on the line, the close is inhibited. When this voltage is above a prescribed level, then there is probably only a standing vehicle and the close is permitted.

Line test devices may be coupled with auto-reclose schemes, thereby inhibiting a reclose if the original trip was due to a fault which had not cleared itself in the dead time.

Line test devices can be by-passed if the line is already live from the line circuit-breaker at the remote end.

The purchaser should specify the need for a line test device and the following information:

a) value of the resistor and, by consequence, the current value to be chosen from 5 A to 25 A;

b) whether the line test device is combined with auto-reclose.

5 Protection systems

5.1 Protection system of line circuit-breakers

Line circuit-breakers are only required to trip the faults on their own section of line.

The protection relays should be selected to have characteristics and settings which will discriminate between heavy load caused by trains on their section of line and faults of the line itself.

The characteristics may be selected from the following types of relays:

a) high set instantaneous overcurrent, with or without a variable time delay. Usually for close up faults;

b) impedance relay with a specified characteristic (e.g. to protect the overhead contact line);

c) inverse time delay with selective pick up and time multiplier (e.g. to protect the overhead contact line);

d) same as c) but with thermal time constant to improve the protection of the overhead contact line;

e) reverse current, able to detect a current flowing from overhead contact line to the incoming power supply. To discriminate regenerating current and a current due to a fault within the power supply network;

f) loss of busbar voltage should give an alarm or automatic tripping of all line circuit-breakers connected thereto.

All relays are to be designed, manufactured and tested to the relevant standards. An informative list of the main applicable standards is given in the Bibliography.

5.2 Protection system of feeder circuit-breakers

5.2.1 Autotransformer application

If the circuit-breaker of the "negative" feeder cable is mechanically or electrically interlocked with the circuit-breaker feeding the overhead contact line, then a common protection scheme may be used.

If these circuit-breakers are not interlocked, then a separate protection scheme for the "negative" feeder is needed for each circuit-breaker.

5.2.2 Other applications

The protection system should take into account special types of faults, depending on the feeder/overhead contact line application, which may involve the following:

– long feeder cables;
– feeder to overhead contact line;
– "+" feeder to "-" feeder;
– feeder to protective wire;
– overhead contact line to protective wire;
– feeder to earth (where protective wire is isolated from earth);
– overhead contact line to earth (earth to limit ground return currents);

NOTE This can be considered as evolving faults as the nominal insulation of the protective wire system (3 kV typically) flashes over.

– return circuits, where booster transformers are installed.

For single phase incoming feeders at traction voltage associated with the railway systems, unit protection may be applied. This may take the form of current differential protection, using pilot wires or other communications between the feeder terminals.

5.3 Protection system for the incoming circuit-breaker, if applicable

The incoming circuit-breaker may be fitted with a unit protection scheme for transformer protection or busbar protection on a multiline substation.

The protection system on this circuit-breaker should have higher settings and longer time delays than that of the line circuit-breaker to act as a back up to the line circuit-breaker.