IEC 61992-6

Edition 1.1 2014-04

CONSOLIDATED VERSION

VERSION CONSOLIDÉE

colour inside

Railway applications – Fixed installations – DC switchgear – Part 6: DC switchgear assemblies

Applications ferroviaires – Installations fixes – Appareillage à courant continu – Partie 6: Ensembles d'appareillage à courant continu

IEC 61992-6:2006-02+AMD1:2014-04 CSV(en-fr)

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INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

COMMISSION
ELECTROTECHNIQUE
INTERNATIONALE

ICS 45.060

ISBN 978-2-8322-1546-3

IEC 61992-6

Edition 1.1 2014-04

REDLINE VERSION

VERSION REDLINE

colour inside

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FOREWORD

1) The International Electrotechnical Commission (IEC) is a worldwide organization for standardization comprising all national electrotechnical committees (IEC National Committees). The object of IEC is to promote international co-operation on all questions concerning standardization in the electrical and electronic fields. To this end and in addition to other activities, IEC publishes International Standards, Technical Specifications, Technical Reports, Publicly Available Specifications (PAS) and Guides (hereafter referred to as "IEC Publication(s)"). Their preparation is entrusted to technical committees; any IEC National Committee interested in the subject dealt with may participate in this preparatory work. International, governmental and non-governmental organizations liaising with the IEC also participate in this preparation. IEC collaborates closely with the International Organization for Standardization (ISO) in accordance with conditions determined by agreement between the two organizations.

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This Consolidated version of IEC 61992-6 bears the edition number 1.1. It consists of the first edition (2006-02) [documents 9/891/FDIS and 9/913/RVD] and its amendment 1 (2014-04) [documents 9/1792/CDV and 9/1852/RVC]. The technical content is identical to the base edition and its amendment.

In this Redline version, a vertical line in the margin shows where the technical content is modified by amendment 1. Additions and deletions are displayed in red, with deletions being struck through. A separate Final version with all changes accepted is available in this publication.

This publication has been prepared for user convenience.

International Standard IEC 61992-6 has been prepared by IEC technical committee 9: Electrical equipment and systems for railways.

IEC 61992 consists of the following parts, under the general title *Railway applications – Fixed installations – DC switchgear*:

Part 1: General

Part 2: D.C. circuit breakers

Part 3: Indoor d.c. disconnectors, switch-disconnectors and earthing switches

Part 4: Outdoor d.c. disconnectors, switch-disconnectors and earthing switches

Part 5: Surge arresters and low-voltage limiters for specific use in d.c. systems

Part 6: D.C. switchgear assemblies

Part 7-1: Measurement, control and protection devices for specific use in d.c. traction systems – Application guide

Part 7-2: Measurement, control and protection devices for specific use in d.c. traction systems – Isolating current transducers and other current measuring devices

Part 7-3: Measurement, control and protection devices for specific use in d.c. traction systems – Isolating voltage transducers and other voltage measuring devices

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- amended.

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RAILWAY APPLICATIONS – FIXED INSTALLATIONS – DC SWITCHGEAR –

Part 6: DC switchgear assemblies

1 Scope

This part of IEC 61992 covers d.c. metal-enclosed and non-metallic enclosed switchgear assemblies used in indoor stationary installations of traction systems, with nominal voltage not exceeding 3 000 V.

It is intended that individual items of equipment, for example circuit breakers, housed in the assembly are designed, manufactured and individually tested (simulating the enclosure when necessary) in accordance with their respective parts of IEC 61992 or, when appropriate, with another applicable standard.

NOTE 1 The requirements covered in this part of IEC 61992 are those concerning the assembly as such, its enclosure and the mutual influence of the equipment enclosed.

NOTE 2 EMC requirements are covered by IEC 62236-5 and additional requirements concerning dependability (RAMS) are covered by IEC 62278.

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 60243-1:1998, *Electrical strength of insulating materials – Test methods – Part 1: Tests at power frequencies*

IEC 60529:1989, *Degrees of protection provided by enclosures (IP Code)*

IEC 61992-1:2006+ A1:2014, *Railway applications – Fixed installations – DC switchgear – Part 1: General*

IEC 61992-2:2006+ A1:2014, *Railway applications – Fixed installations – DC switchgear – Part 2: DC circuit-breakers*

IEC 61992-3:2006, *Railway applications – Fixed installations – DC switchgear – Part 3: Indoor d.c. disconnectors, switch-disconnectors and earthing switches*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in IEC 61992-1 apply.

4 Service requirements

Normal service requirements are detailed in Clause 4 and Annex B of IEC 61992-1 for indoor installations. In this standard, the pollution degree PD4 and overvoltage categories (see notes to Table 1 of IEC 61992-1) as described in EN 50124-1 are considered to be the normal condition.

5 Characteristics of the assemblies

The main characteristics of an assembly shall be indicated in the procurement specification as follows:

a) type of the assembly enclosure;

b) list of functional units enclosed;

c) rated insulation voltages;

d) rated values of the equipment enclosed as required in relevant standards;

e) if constructed for an earth fault protection;

f) detailed protection and control requirements (see IEC 61992-7).

Other important characteristics are listed in Clause A.2.

6 Construction characteristics

6.1 General

Enclosures are either metallic or non-metallic. Non-metallic enclosed switchgear shall not be used for nominal voltages above 1,5 kV.

All requirements specified herein also apply when both conductive and insulating materials are used, except for insulating clearances which shall be designed and tested as appropriate.

A cell made of masonry shall not be considered as an enclosure, as far as this standard is concerned.

The floor surface may be considered as part of an enclosure. The measures to be taken in order to obtain the degree of protection provided by floor surfaces shall be subject to an agreement between purchaser and supplier.

The walls of a room shall not be considered as parts of the enclosure.

Switchgear assemblies and relevant enclosures shall be designed so that normal service, inspection and maintenance operations, earthing of connected cables or busbars, locating of cable faults, voltage tests on connected cables or other apparatus and the elimination of electrostatic charges, can be carried out easily and safely.

All materials used shall be of the quality and of the class most suitable for working under the conditions specified. Special attention is to be paid to its ability to withstand moisture and fire: unless fire behaviour Class F0 is allowed (see Annex B of IEC 61992-1), materials used shall be metallic or of the self-extinguishing type, so that the risk of propagation of fire from one cubicle or compartment to another is minimised.

The selection of materials and the construction of the assembly shall be such that corrosion due to atmospheric and electrolytic effects are minimised.

All identical devices, forming part of an assembly for a given use and with the same characteristics, shall be interchangeable.

Withdrawable switching devices shall be prevented from insertion into functional units on the same switchgear assembly, having a different function or higher current ratings.

Sufficient space shall be provided inside the compartments for the entry and termination of incoming cables without their minimum bending radii being infringed.

The detachable parts of the protection enclosures shall be firmly attached to the fixed parts as specified in 6.7. Accidental untightening or detachment shall not occur because of the operation of the equipment.

All apparatus and connections for the safe operation, control and protection of the equipment concerned, shall be provided whether or not specifically mentioned. The equipment shall be adequately earthed, insulated, screened or enclosed as may be appropriate to ensure the protection of the equipment and safety of those concerned in its operation and maintenance.

Control and auxiliary circuits and contacts shall comply with the requirements of 5.2 of IEC 61992-1.

All components contained within the enclosure shall comply with their relevant standards.

6.2 Insulation requirements

Test voltages and clearances are given in Table 1 of IEC 61992-1. Recommended values for creepage distances are given in Annex D of IEC 61992-1.

The adverse effect of ionisation (due to arcs) on the clearances of other equipment in the assembly shall be taken into account. The minimum clearances between the arc chute of a switching device and metallic or non-metallic parts (i.e. above the arc chute and to the sides) shall be in accordance with those given by the switching device manufacturer.

Insulating material used to fully or partially line a metallic enclosure shall be firmly secured to the enclosure.

In case of withdrawable units, where access within the enclosure is required during maintenance operations, the busbars and all other conductors shall be separated by a barrier. Openings through such a barrier for the circuit and busbar connectors, etc. shall be shuttered and capable of being locked closed.

6.3 Primary connections

Non-withdrawable functional units may be equipped with fixed, removable (bolted or clamped) connectors. Withdrawable functional units may be equipped with plug-in connectors.

6.4 Location of the primary connections

In case of non-withdrawable assemblies, the terminals for the primary connections shall be accessible with the functional units as in normal operating conditions.

6.5 Earthing

NOTE Depending on the d.c. system earthing requirements, "earthing" means connection either to earth or to the return circuit.

6.5.1 Earthing of the main circuit

To ensure safety during maintenance work, all parts of the main circuit to which access is required or provided shall be capable of being earthed through suitable means. This does not apply to those parts, which are withdrawable or removable and which become accessible after being separated from the switchgear.

A withdrawable part, however, shall not be removed from the enclosure unless capacitors on it have been discharged to safe values.

In case of withdrawable circuit breakers, the earth connection shall be made before the shutters are opened and the shutters shall be closed before the earth connection is disconnected.

Earthing switches shall comply with IEC 61992-3. The requirement that it shall be possible to know the operating position of the earthing switch is met if one of the following conditions is fulfilled:

– the isolating distance is visible;
– the position of the earthing switch is clearly visible and the position corresponding to full connection and full isolation are clearly identified;
– the position of the earthing switch is indicated by a reliable indicating device.

6.5.2 Earthing of the enclosure

The purchaser shall indicate in the enquiry how to earth the enclosure (e.g. the return circuit or to earth) in accordance with 6.5.8 of IEC 61992-7-1.

The metallic parts of the enclosures, such as frames, structure and fixed elements, shall be connected to each other and to a suitable earthing terminal, placed in an accessible position, in order to allow the connection to the main earth system of the installation. The earthing terminal shall be suitably protected against corrosion. The standard earth symbol shall be clearly and permanently marked.

An earthing conductor shall be provided extending the whole length of the metal-enclosed switchgear to connect the individual earthing terminals. The current density of the earthing conductor, if of copper, shall not exceed 200 A/mm^2 based on a specified earth fault of 10 000 A for 1 s; therefore, its cross-section area shall be not less than 50 mm^2. The earthing conductor shall be terminated by a clearly and permanently marked main earthing terminal.

The continuity of the earth system shall be ensured taking into account the thermal and mechanical stresses caused by the magnitude and duration of the current it may have to carry.

The purchaser shall indicate in the enquiry if the earthing system shall differ from the above.

The purchaser shall specify in the enquiry the maximum earth fault current. The standard value for the duration is 0,25 s due to the typical breaking time of the a.c. rectifier circuit breaker(s). If the purchaser requires a longer duration, he shall specify this in the enquiry.

The terminals and connections shall be adequately dimensioned for the earth fault current.

The enclosure of each functional unit shall be connected to this earthing conductor. All the metallic parts within a functional unit and not belonging to a main, control or auxiliary circuit, shall also be connected to the earthing conductor directly or through metallic structural parts.

In the latter case, earthing of said elements, such as walls and doors of compartments, may be fulfilled by normal construction elements, ensuring an adequate electrical continuity and suitable dimensioning. For any bolts or similar fixing used for earth continuity, the maintenance instructions shall state the requirements for cleaning surfaces and ensuring tightness.

The metallic parts of a withdrawable part which are normally earthed in the service position, shall also remain earth-connected in the test and disconnected positions and between each position.

The purchaser shall indicate in the enquiry if the earthing system deviates from the requirements stated in this subclause.

6.6 Degree of protection and internal fault

6.6.1 Protection against approach to live parts and contact with moving parts

For metal-clad and for compartmented switchgear, the degree of protection shall be specified. If required, separate degrees of protection for doors and walls, for partitions and for the roof of the enclosure shall be specified. For cubicle switchgear, it is only necessary to specify the degree of protection for the enclosure.

The degree of protection against contact of persons with live parts of auxiliary circuits and with any moving parts (other than smooth rotating shafts and moving linkages) shall be indicated by means of the designation specified in Table 1 below, taken from IEC 60529.

Normally, no degree of protection is provided for indoor switchgear assemblies against ingress of water.

Table 1 – Degrees of protection

Degree of protection	Protection against approach of live parts and contact with moving parts
IP20	By fingers or similar objects of diameter greater than 12 mm
IP30	By tools, wires, etc. of diameter of thickness greater than 2,5 mm
IP40	By tools, wires, etc. of diameter of thickness greater than 1,0 mm
NOTE 1 The first characteristic numeral indicates the degree of protection provided by the enclosure against the ingress of solid bodies and approach to live parts for all given enclosure conditions. NOTE 2 Protection against ingress of water is given by the second numeral.	

6.6.2 Internal arcing

Failure within the enclosure of switchgear due to a defect or an exceptional service condition or mal-operation may initiate an exceptional internal arc.

Ventilating openings and vent outlets shall be arranged in such a way that gas or vapour escaping under pressure does not endanger the operator.

6.7 Covers and doors

Covers and doors which are part of the enclosure shall be metallic if the enclosure is metallic. When they are closed, they shall provide the degree of protection specified for the enclosure.

Covers or doors shall not be made of woven wire mesh, expanded metal or similar. When ventilating openings and vent outlets are incorporated in the cover or door, reference is made to 6.9.

Two categories of covers or doors are recognized with regard to access to compartments at main circuit potential:

a) those which need not to be opened for the normal purposes of operation or maintenance (fixed covers): it shall not be possible for them to be opened, dismantled or removed without the use of tools or other provisions which may be required by the purchaser;

b) those which need to be opened for the normal purposes of operation (removable covers, doors): these shall not require tools for their opening or removal; they shall be provided with locking facilities (for example provisions for padlocks), unless the safety of persons is assured by a suitable interlocking device.

NOTE It is recommended, with metal-clad or compartmented switchgear, that doors giving access to live parts be suitable for opening only when the part of the exposed main circuit contained in the compartment being made accessible is dead. Equivalent provisions may also be provided.

6.8 Inspection windows

Inspection windows shall provide at least the degree of protection specified for the enclosure.

They shall be covered by a transparent sheet of mechanical strength comparable to that of the enclosure.

The insulation between live parts of the main circuit and the inspection windows shall withstand the test voltages specified in Table 1 of IEC 61992-1.

6.9 Ventilating openings

Ventilating openings shall be so arranged or shielded that the same degree of protection as that specified for the enclosure is obtained. Such openings may make use of wire mesh or the like, provided that it is of suitable mechanical strength.

6.10 Partitions and shutters

6.10.1 General

Partitions and shutters shall provide at least the degree of protection specified in Table 1.

Partitions and shutters made of insulating material shall meet the following requirements:

a) the insulation between live parts of the main circuit and the accessible surface of insulating partitions and shutters shall withstand the test voltages specified in Table 1 of IEC 61992-1;

b) apart from mechanical strength, the insulating material shall withstand the test voltages specified in item a); the appropriate test method given in IEC 60243-1 shall be applied;

c) if a leakage current reaches the accessible side of the insulating partitions and shutters by a continuous path over insulating surfaces or by a path broken only by small air gaps, this current shall be not greater than 0,5 mA under the specified test conditions (see 8.3.3.1 a)).

Openings in the enclosure of the switchgear assembly and in partitions of metal-clad or compartmented switchgear, through which contacts of removable parts engage fixed contacts, shall be provided with automatic shutters properly operated in normal service operations to ensure the protection of persons in any of the positions defined in 3.3.24 to 3.3.27 of IEC 61992-1.

If maintenance requirements imply that one set of fixed contacts shall be accessible through opened shutters, all the shutters shall be provided with means of locking them independently in the closed position or it shall be possible to insert a screen to prevent the live set of the fixed contacts being exposed.

Conductors other than busbars passing through metallic partitions are insulated by bushings or other equivalent means and the openings may be provided by bushings or shutters having non-metallic parts.

6.10.2 Partitions

Partitions of metal-clad switchgear shall be metallic and earthed.

Partitions of compartmented and cubicle switchgear may be non-metallic, provided (unless otherwise agreed between purchaser and supplier) they do not become part of the enclosure with the removable part in any of the positions defined in 3.3.25 to 3.3.27 of IEC 61992-1. If partitions become part of the enclosure with the removable part in any of these positions, they shall be of the same material as the enclosure and shall provide the degree of protection specified for the enclosure. Metallic partitions shall be earthed.

NOTE 1 A partition becomes part of the enclosure, if it is accessible in any of the positions defined in 3.3.25 to 3.3.27 of IEC 61992-1.