INTERNATIONAL STANDARD

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

Warning! Make sure that you obtained this publication from an authorized distributor.

© Registered trademark of the International Electrotechnical Commission
Railway applications – Fixed installations – DC switchgear – Part 6: DC switchgear assemblies
CONTENTS

1 Scope ............................................................................................................................... 6
2 Normative references ................................................................................................. 6
3 Terms and definitions ............................................................................................... 6
4 Service requirements ................................................................................................. 7
5 Characteristics of the assemblies .............................................................................. 7
6 Construction characteristics ..................................................................................... 7
   6.1 General .................................................................................................................. 7
   6.2 Insulation requirements ....................................................................................... 8
   6.3 Primary connections ............................................................................................ 9
   6.4 Location of the primary connections .................................................................. 9
   6.5 Earthing ................................................................................................................ 9
      6.5.1 Earthing of the main circuit ......................................................................... 9
      6.5.2 Earthing of the enclosure ............................................................................ 9
   6.6 Degree of protection and internal fault ............................................................... 10
      6.6.1 Protection against approach to live parts and contact with moving parts ...... 10
      6.6.2 Internal arcing ................................................................................................ 11
   6.7 Covers and doors ................................................................................................... 11
   6.8 Inspection windows ............................................................................................. 11
   6.9 Ventilating openings ............................................................................................ 12
   6.10 Partitions and shutters ....................................................................................... 12
      6.10.1 General ......................................................................................................... 12
      6.10.2 Partitions ...................................................................................................... 12
      6.10.3 Shutters ......................................................................................................... 12
      6.10.4 Isolating distances ....................................................................................... 13
   6.11 Interlocks ............................................................................................................. 13
   6.12 Temperature-rises .............................................................................................. 14
   6.13 Dielectric strength ............................................................................................. 14
   6.14 Painting and finishing ........................................................................................ 14
   6.15 Noise emission ................................................................................................... 14
   6.16 Cooling and heating ............................................................................................ 14
   6.17 Operating temperature of auxiliary and control equipment ............................. 14
   6.18 Rated short-time withstand current of busbars .................................................. 14
7 Information and marking ............................................................................................ 15
   7.1 Information ........................................................................................................... 15
   7.2 Marking ................................................................................................................ 15
8 Tests ............................................................................................................................... 15
   8.1 General .................................................................................................................. 15
   8.2 List of the applicable tests .................................................................................... 16
   8.3 Performance of tests ............................................................................................. 16
      8.3.1 Verification of conformity to the manufacturing drawings and to characteristics of the assembly .......................................................... 16
      8.3.2 Operation test ................................................................................................ 17
      8.3.3 Dielectric tests ................................................................................................ 17
      8.3.4 Short-time withstand current tests ................................................................ 19
      8.3.5 Mechanical operation test ............................................................................. 21
8.3.6 Verification of the degree of protection ...................................................... 21
8.3.7 Temperature-rise tests .............................................................................. 21
8.3.8 Electrical operation test ............................................................................. 23
8.3.9 Internal arc test ......................................................................................... 24

Annex A (informative) Information required ........................................................................ 25
A.1 General ................................................................................................................. 25
A.2 Procurement specification ..................................................................................... 25
A.3 Manufacturer’s tender specification ....................................................................... 26
A.4 Information and data to be supplied by the manufacturer during the delivery stage ..................................................................................................................... 27

Annex B (normative) Method for testing under conditions of arcing due to an internal fault ...................................................................................................................................... 29
B.1 Purpose of the test ................................................................................................ 29
B.2 Characteristics – Rated short-circuit current under internal arcing conditions
(I_{Narc}) .................................................................................................................. 29
B.3 Test arrangements ................................................................................................ 29
B.3.1 Test specimen ........................................................................................... 29
B.3.2 Test circuit ................................................................................................ 30
B.3.3 Voltage ...................................................................................................... 30
B.3.4 Duration of the test .................................................................................... 30
B.4 Test procedure ...................................................................................................... 30
B.4.1 Supply circuit ............................................................................................. 30
B.4.2 Arc initiation .............................................................................................. 31
B.4.3 Indicators .................................................................................................. 32
B.4.4 Repetition of the test ................................................................................. 32
B.5 Assessment of the test .......................................................................................... 32
B.6 Test report ............................................................................................................ 33

Figure 1 – Test arrangement for short-time current withstand test on busbars ....................... 20
Figure 2 – Test arrangement for temperature-rise test on main circuits ................................. 22
Figure 3 – Test arrangement for temperature-rise test on the busbars .................................. 23
Figure B.1 – Room simulation and indicator positioning, functional unit fitted with roof ........ 34
Figure B.2 – Mounting frame for vertical indicators ............................................................... 35
Figure B.3 – Indicators arranged in a checkerboard pattern .................................................. 35

Table 1 – Degrees of protection ............................................................................................ 11
Table 2 – List of applicable tests ........................................................................................... 16
Table B.1 – Sizes of the copper ignition wire ........................................................................ 31
RAILWAY APPLICATIONS – FIXED INSTALLATIONS – DC SWITCHGEAR –

Part 6: DC switchgear assemblies

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.

2) The formal decisions or agreements of IEC on technical matters express, as nearly as possible, an international consensus of opinion on the relevant subjects since each technical committee has representation from all interested IEC National Committees.

3) IEC Publications have the form of recommendations for international use and are accepted by IEC National Committees in that sense. While all reasonable efforts are made to ensure that the technical content of IEC Publications is accurate, IEC cannot be held responsible for the way in which they are used or for any misinterpretation by any end user.

4) In order to promote international uniformity, IEC National Committees undertake to apply IEC Publications transparently to the maximum extent possible in their national and regional publications. Any divergence between any IEC Publication and the corresponding national or regional publication shall be clearly indicated in the latter.

5) IEC itself does not provide any attestation of conformity. Independent certification bodies provide conformity assessment services and, in some areas, access to IEC marks of conformity. IEC is not responsible for any services carried out by independent certification bodies.

6) All users should ensure that they have the latest edition of this publication.

7) No liability shall attach to IEC or its directors, employees, servants or agents including individual experts and members of its technical committees and IEC National Committees for any personal injury, property damage or other damage of any nature whatsoever, whether direct or indirect, or for costs (including legal fees) and expenses arising out of the publication, use of, or reliance upon, this IEC Publication or any other IEC Publications.

8) Attention is drawn to the Normative references cited in this publication. Use of the referenced publications is indispensable for the correct application of this publication.

9) Attention is drawn to the possibility that some of the elements of this IEC Publication may be the subject of patent rights. IEC shall not be held responsible for identifying any or all such patent rights.

This consolidated version of the official IEC Standard and its amendments has been prepared for user convenience.


In this Redline version, a vertical line in the margin shows where the technical content is modified by amendments 1 and 2. Additions are in green text, deletions are in strikethrough red text. A separate Final version with all changes accepted is available in this publication.

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

The committee has decided that the contents of the base publication and its amendments will remain unchanged until the stability 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.

IMPORTANT – The “colour inside” logo on the cover page of this publication indicates that it contains colours which are considered to be useful for the correct understanding of its contents. Users should therefore print this publication using a colour printer.
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 60529:1989, Degrees of protection provided by enclosures (IP Code)


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

1 Scope ............................................................................................................................................. 6
2 Normative references .................................................................................................................. 6
3 Terms and definitions .................................................................................................................. 6
4 Service requirements ................................................................................................................... 7
5 Characteristics of the assemblies ................................................................................................ 7
6 Construction characteristics ....................................................................................................... 7
   6.1 General ..................................................................................................................................... 7
   6.2 Insulation requirements .......................................................................................................... 8
   6.3 Primary connections ............................................................................................................... 9
   6.4 Location of the primary connections ...................................................................................... 9
   6.5 Earthing .................................................................................................................................. 9
      6.5.1 Earthing of the main circuit .......................................................................................... 9
      6.5.2 Earthing of the enclosure ............................................................................................. 9
   6.6 Degree of protection and internal fault .................................................................................. 10
      6.6.1 Protection against approach to live parts and contact with moving parts .................. 10
      6.6.2 Internal arcing ............................................................................................................... 10
6.7 Covers and doors ...................................................................................................................... 11
6.8 Inspection windows .................................................................................................................. 11
6.9 Ventilating openings ................................................................................................................ 11
6.10 Partitions and shutters ........................................................................................................... 11
      6.10.1 General ....................................................................................................................... 11
      6.10.2 Partitions .................................................................................................................... 12
      6.10.3 Shutters ..................................................................................................................... 12
      6.10.4 Isolating distances ...................................................................................................... 12
6.11 Interlocks ................................................................................................................................ 13
6.12 Temperature-rises ................................................................................................................... 13
6.13 Dielectric strength .................................................................................................................. 14
6.14 Painting and finishing ............................................................................................................ 14
6.15 Noise emission ........................................................................................................................ 14
6.16 Cooling and heating ................................................................................................................ 14
6.17 Operating temperature of auxiliary and control equipment ................................................... 14
6.18 Rated short-time withstand current of busbars ...................................................................... 14
7 Information and marking ............................................................................................................ 14
   7.1 Information .......................................................................................................................... 14
   7.2 Marking ................................................................................................................................ 15
8 Tests ............................................................................................................................................. 15
   8.1 General .................................................................................................................................. 15
   8.2 List of the applicable tests ...................................................................................................... 16
   8.3 Performance of tests .............................................................................................................. 16
      8.3.1 Verification of conformity to the manufacturing drawings and to characteristics of the assembly .................................................................................................................. 16
      8.3.2 Operation test ............................................................................................................... 16
      8.3.3 Dielectric tests .............................................................................................................. 17
      8.3.4 Short-time withstand current tests ............................................................................... 19
      8.3.5 Mechanical operation test ........................................................................................... 20
8.3.6 Verification of the degree of protection ...................................................... 21
8.3.7 Temperature-rise tests .............................................................................. 21
8.3.8 Electrical operation test ............................................................................. 23
8.3.9 Internal arc test ......................................................................................... 23

Annex A (informative) Information required .......................................................... 24
A.1 General ................................................................................................................. 24
A.2 Procurement specification ..................................................................................... 24
A.3 Manufacturer’s tender specification ....................................................................... 25
A.4 Information and data to be supplied by the manufacturer during the delivery stage ..................................................................................................................... 26

Annex B (normative) Method for testing under conditions of arcing due to an internal fault ...................................................................................................................................... 28
B.1 Purpose of the test ................................................................................................ 28
B.2 Characteristics – Rated short-circuit current under internal arcing conditions (I_{Narc}) .................................................................................................................. 28
B.3 Test arrangements ............................................................................................... 28
B.3.1 Test specimen ........................................................................................... 28
B.3.2 Test circuit ................................................................................................ 29
B.3.3 Voltage ...................................................................................................... 29
B.3.4 Duration of the test .................................................................................... 29
B.4 Test procedure ...................................................................................................... 29
B.4.1 Supply circuit ............................................................................................. 29
B.4.2 Arc initiation .............................................................................................. 30
B.4.3 Indicators .................................................................................................. 31
B.4.4 Repetition of the test ................................................................................. 31
B.5 Assessment of the test .......................................................................................... 31
B.6 Test report ............................................................................................................ 32

Figure 1 – Test arrangement for short-time current withstand test on busbars .......... 20
Figure 2 – Test arrangement for temperature-rise test on main circuits ................. 22
Figure 3 – Test arrangement for temperature-rise test on the busbars ....................... 22
Figure B.1 – Room simulation and indicator positioning, functional unit fitted with roof .......................................................................................................................... 33
Figure B.2 – Mounting frame for vertical indicators ................................................ 34
Figure B.3 – Indicators arranged in a checkerboard pattern ......................................... 34

Table 1 – Degrees of protection ............................................................................. 10
Table 2 – List of applicable tests ............................................................................. 16
Table B.1 – Sizes of the copper ignition wire ............................................................. 30
**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.

2) The formal decisions or agreements of IEC on technical matters express, as nearly as possible, an international consensus of opinion on the relevant subjects since each technical committee has representation from all interested IEC National Committees.

3) IEC Publications have the form of recommendations for international use and are accepted by IEC National Committees in that sense. While all reasonable efforts are made to ensure that the technical content of IEC Publications is accurate, IEC cannot be held responsible for the way in which they are used or for any misinterpretation by any end user.

4) In order to promote international uniformity, IEC National Committees undertake to apply IEC Publications transparently to the maximum extent possible in their national and regional publications. Any divergence between any IEC Publication and the corresponding national or regional publication shall be clearly indicated in the latter.

5) IEC itself does not provide any attestation of conformity. Independent certification bodies provide conformity assessment services and, in some areas, access to IEC marks of conformity. IEC is not responsible for any services carried out by independent certification bodies.

6) All users should ensure that they have the latest edition of this publication.

7) No liability shall attach to IEC or its directors, employees, servants or agents including individual experts and members of its technical committees and IEC National Committees for any personal injury, property damage or other damage of any nature whatsoever, whether direct or indirect, or for costs (including legal fees) and expenses arising out of the publication, use of, or reliance upon, this IEC Publication or any other IEC Publications.

8) Attention is drawn to the Normative references cited in this publication. Use of the referenced publications is indispensable for the correct application of this publication.

9) Attention is drawn to the possibility that some of the elements of this IEC Publication may be the subject of patent rights. IEC shall not be held responsible for identifying any or all such patent rights.

This consolidated version of the official IEC Standard and its amendments has been prepared for user convenience.


This Final version does not show where the technical content is modified by amendments 1 and 2. A separate Redline version with all changes highlighted is available in this publication.

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

The committee has decided that the contents of the base publication and its amendments will remain unchanged until the stability 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.

IMPORTANT – The “colour inside” logo on the cover page of this publication indicates that it contains colours which are considered to be useful for the correct understanding of its contents. Users should therefore print this publication using a colour printer.
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 60529:1989, Degrees of protection provided by enclosures (IP Code)

