IEC TR 62271-306

Edition 1.1 2018-08
CONSOLIDATED VERSION

TECHNICAL REPORT

colour inside

High-voltage switchgear and controlgear – Part 306: Guide to IEC 62271-100, IEC 62271-1 and other IEC standards related to alternating current circuit-breakers

INTERNATIONAL ELECTROTECHNICAL COMMISSION

ICS 29.130.10

ISBN 978-2-8322-6010-4

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IEC TR 62271-306:2012-12+AMD1:2018-08 CSV(en)

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HIGH-VOLTAGE SWITCHGEAR AND CONTROLGEAR –

Part 306: Guide to IEC 62271-100, IEC 62271-1 and other IEC standards related to alternating current circuit-breakers

FOREWORD

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

A list of all parts in the IEC 62271 series, published under the general title *High-voltage switchgear and controlgear*, can be found on the IEC website.

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This amendment includes the following significant technical changes.

– Annex G of IEC 62271-1:2007 has been included;

– Annexes E, G, H, J, L and Q of IEC 62271-1:2007 have been included;

– I.2 of IEC 62271-100:2008 + A1:2012 has been included;

– Informative parts of Annex O of IEC 62271-100:2008 have been included;

– Former Clause 14 has been added to Clause 13;

– Clause 14 now has heading "Synthetic making and breaking tests". This clause contains annexes A, B, C, D and G of IEC 62271-101;

– Clause 9 has been restructured;

– 16.4 (No-load transformer switching) has been rewritten;

– Annex B has been expanded to include information about fully compensated transmission lines and cables;

– Annex D has been rewritten.

HIGH-VOLTAGE SWITCHGEAR AND CONTROLGEAR –

Part 306: Guide to IEC 62271-100, IEC 62271-1 and other IEC standards related to alternating current circuit-breakers

1 General

1.1 Scope

This part of IEC 62271 is applicable to a.c. circuit-breakers designed for indoor or outdoor installation and for operation at frequencies of 50 Hz and 60 Hz on systems having voltages above 1 000 V.

NOTE While this technical report mainly addresses circuit-breakers, some clauses (e.g. Clause 5) apply to switchgear and controlgear.

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This technical report does not cover circuit-breakers intended for use on motive power units of electrical traction equipment; these are covered by the IEC 60077 series.

Generator circuit-breakers installed between generator and step-up transformer are not within the scope of this technical report.

This technical report does not cover self-tripping circuit-breakers with mechanical tripping devices or devices which cannot be made inoperative.

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By-pass switches in parallel with line series capacitors and their protective equipment are not within the scope of this technical report. These are covered by IEC 62271-109 and IEC 60143-2.

In addition, special applications (among others parallel switching, delayed current zero crossings) are treated in annexes to this document.

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IEC 60480, *Guidelines for the checking and treatment of sulfur hexafluoride (SF_6) taken from electrical equipment and specification for its re-use*

IEC 62146-1, *Grading capacitors for high-voltage alternating current circuit-breakers*[1]

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IEC 62271-4, *High-voltage switchgear and controlgear – Part 4: Handling procedures for sulphur Hexafluoride (SF_6)* [2]

IEC 62271-100:2008, *High-voltage switchgear and controlgear – Part 100: Alternating-current circuit-breakers*
Amendment 1:2012~~[3]~~
Amendment 2:2017

IEC 62271-101:2012, *High-voltage switchgear and controlgear – Part 101: Synthetic testing*

IEC 62271-102:2001, *High-voltage switchgear and controlgear – Part 102: Alternating current dosconnectors and earthing switches*

IEC 62271-110:2012, *High-voltage switchgear and controlgear – Part 110: Inductive load switching*

IEC 62271-310, *High-voltage switchgear and controlgear – Part 310: Electrical endurance testing for circuit-breakers above a rated voltage of 52 kV*

2 Evolution of IEC standards for high-voltage circuit-breaker

Questions arise frequently concerning the basis and interpretation of standards IEC 62271-100 and IEC 62271-1. In most cases, these questions were due to a lack of background knowledge of the values and requirements laid down in these standards.

A selected number of reference textbooks is listed in the Bibliography. It must be remembered that the technology of high-voltage circuit-breakers is continuously progressing and will continue to do so in the future. Therefore, it is advisable to use such textbooks primarily as a source of information on network behaviour, such as switching conditions, transients, etc., and not for switchgear design.

As the installation of standard equipment in general is more economical than special designs, the application guide will help the utility and industrial engineers in the selection of the appropriate ratings to conform to their needs and specifications. It will enable them to judge which rating is necessary when specifying their circuit-breakers. This should take into account that in future high-voltage networks which will be worked harder and closer to their limits and that high-voltage circuit-breakers of present day technology are designed and procured for a

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1 To be published.

2 To be published.

~~3 To be published.~~

lifetime of several decades. It is recognised that certain conditions may necessitate requirements which are outside the circuit-breaker standards. In such cases, the technical report will help to specify the various ratings or possible additional testing to verify the suitability of the circuit-breaker for a specific application or condition.

Standards should be written fit for purpose, i.e. they should reflect general system requirements to ensure that the installed equipment works properly. Although it is recognised that not 100 % of all conditions occurring in service can be covered, long term experience with high-voltage switchgear standards shows that system conditions are generally covered adequately. Nevertheless, the feedback from service and new developments in equipment and networks must be taken into account in their revision, making standardization an ongoing process. This technical report will be a forum to provide the necessary information concerning the background of changes in the standards.

Technical specification aspects are not generally considered in standards. However, this application guide will address such aspects where appropriate.

As high-voltage transmission and distribution systems and high-voltage circuit-breakers developed it was found necessary to provide standards for circuit-breakers, first on national basis. For example, already in 1923 the first edition of the British Standard B.S.S. No. 116 for circuit-breakers was issued.

In the late 1920s it was recognized that an international agreement should be obtained for a specification for high-voltage circuit-breakers, particularly with respect to their behaviour under short-circuit condition. This lead to the establishment of the "IEC Advisory Committee No. 17" which met for the first time in Stockholm in 1930 and drafted some preliminary recommendations on the international standardization of circuit-breakers.

After a series of specially convened meetings the first IEC Specification No. 56 for Alternating-Current Circuit-Breakers, Chapter I, Rules for Short-Circuit Conditions, was issued in the summer of 1937, with international approval and recognition as a basis upon which to establish national specifications. The first edition of IEC 56 was bilingual and consisted of 55 pages.

Also at that time, already, the need was seen to have Certificates of Ratings issued by approved Testing Authorities to confirm the compliance with Standard Specifications.

The second world war interrupted the further work on the IEC circuit-breaker standards. In 1954 the second edition was published which used and continued the concept of the first edition. It was intended that the IEC Specification No. 56 should ultimately incorporate five chapters which were to be discussed in the following order:

Chapter I	Rules for short-circuit conditions.
	First edition of Publication 56 to be revised and enlarged in a second edition.
Chapter II	Rules for normal-load conditions.
	Part 1 – Rules for temperature-rise.
	Part 2 – Rules for operating conditions.
Chapter III	Rules for strength of Insulation.
Chapter IV	Rules for the selection of circuit-breakers for service.
Chapter V	Rules for the maintenance of circuit-breakers in service.

Actually, the second edition, as the first one, did not progress beyond Chapter I. It was bilingual and had a total of 77 pages. According to its scope it covered a.c. circuit-breakers of 1 000 V and above.

Some major features were:

– the breaking capacity was expressed in MVA by 2 values, one for a symmetrical and the other for an asymmetrical breaking current;

– the TRV, defined as "restriking voltage", was of single frequency. The amplitude factor or crest value and the TRV frequency or rate-of-rise were not specified but to be evaluated in the tests;

– the first-pole-to-clear factor in general was 1,5. However, in a note allowance was made to use 1,3 for circuit-breakers for earthed systems;

– 50 Hz and 60 Hz were no problem, as for making and breaking tests the tolerance of the frequency was ±25 %;

– the short-circuit current breaking tests consisted of test-duties 1 to 5 with 10 %, 30 %, 60 % and 100 % of the rated symmetrical and the rated asymmetrical breaking current.

Edition 3 was issued in 1971 with a new structure. It applied to high-voltage a.c. circuit-breakers rated above 1 000 V and had six parts which were published as separate booklets:

Publication 56-1: Part 1: General and definitions.

Publication 56-2: Part 2: Rating.

Publication 56-3: Part 3: Design and construction.

Publication 56-4: Part 4: Type tests and routine tests.

Publication 56-5: Part 5: Rules for the selection of circuit-breakers for service.

Publication 56-6: Part 6: Information to be given with enquiries, tenders and orders and rules for transport, erection and maintenance.

IEC 56 consisted of 294 pages when it was issued, but over the years a large number of amendments was added. Out-of-phase was covered by its own publication, IEC 267.

The third edition was the first comprehensive IEC Standard on high-voltage circuit-breakers meeting the originally intended goals. It included, also, the general requirements which are now compiled in IEC 62271-1.

Compared to the second edition a large number of changes were introduced:

– for the first time mechanical tests, tests on insulation properties, tests on auxiliary and control circuits, temperature rise tests, etc., were specified;

– the R 10 series is used for rated normal and breaking currents;

– the TRV (first time to use this term) representation by two or four parameters and the definitions as used up to today are installed;

– for rated voltages up to 100 kV the first-pole to clear factor is 1,5, for 123 kV and above it is alternatively 1,3 or 1,5;

– the supply side rate-of-rise of TRV for 123 kV and above for terminal fault is 1,0 kV/μs for TD 4, 2,0 kV/μs for TD 3 and 5,0 kV/μs for TD 2;

– the short-line fault is introduced. The specified surge impedance is 480 Ω for lines with 1 conductor/phase (52 – 245 kV < 40 kA), 375 Ω for 2 conductors/phase and 330 Ω for 3 or 4 conductors per phase. The line side peak factor is 1,7, 1,6, or 1,5, respectively. The source side rate-of-rise is 0,67 kV/μs;

– test for capacitive current switching (line and cable charging, single capacitors) are prescribed;

– not only type tests, but also routine test procedures are defined.

Edition 4 of IEC 56, published 1987, followed the scheme of the 3rd edition. However, to avoid a duplication of requirements in the various standards for high-voltage switching equipment, IEC 56 was reduced to those requirements that were specific for high-voltage a.c. circuit-breakers. The "common clauses for high-voltage switchgear and controlgear" was published as a separate standard in 1980 with reference number IEC 694.

Edition 4 of IEC 60056 consisted of one book of 329 pages. To conform with actual service conditions some major changes were incorporated:

– as all systems rated 245 kV and higher are effectively earthed only a first-pole-to-clear factor 1,3 is specified for these voltage levels. For 100 kV to 170 kV alternatives 1,3 and 1,5 are specified;
– based on a large number of network investigations the supply side rate-of-rise of TRV is increased to 2,0 kV/μs for 100 %, 3,0 kV/μs for 60 % and 5,0 kV/μs for 30 % rated breaking current;
– to take into account the clashing of the conductors of a line phase due to the forces of the short-circuit current, which makes it similar to a single conductor, a uniform surge impedance of 450 Ω is specified for all short-line fault tests. The line side peak value is 1,6, the supply side rate-of-rise 2,0 kV/μs;
– the initial Transient Recovery Voltage (ITRV) is introduced for rated voltages of and above 100 kV;
– out-of-phase specifications are included;
– to prove that capacitive current breaking is performed without restrikes the number of tests per duty is increased;
– also, the number of operations during mechanical type tests is increased from 1 000 to 2 000.

And still, IEC 60056 continued to grow. The 4th edition was revised, resulting in the first edition of IEC 62271-100 published in 2001. The first edition of IEC 62271-100 had 575 pages. The structure of the document was retained but its content was revised taking into account service experience and requirements by the utilities:

– classifications of circuit-breaker are introduced with respect to mechanical and (for medium voltage) electrical endurance and restrike behaviour when switching capacitive loads;
– more severe test conditions are prescribed for circuit-breakers to prove a very low probability of restrikes in capacitive current switching;
– for type tests the number of test specimen is limited;
– some test procedures are prescribed in more detail;
– critical current tests and single-phase and double-earth fault tests are treated in particular;
– tolerances are given on practically all test quantities during type tests;
– special cases time constants, longer than 45 ms, are specified for the different levels of rated voltages.

The first edition of IEC 62271-100 was revised and the second edition was published in 2008. The following major changes were made:

– the introduction of harmonised (IEC and IEEE) TRV waveshapes for rated voltages of 100 kV and above (amendment 1 to the first edition);
– the introduction of cable and line systems with their associated TRVs for rated voltages below 100 kV (amendment 2 to the first edition);
– the inclusion of IEC 61633 (Guide for short-circuit and switching tests procedures for metal enclosed and dead tank circuit-breakers) and IEC 62271-308 (Guide for asymmetrical short-circuit breaking test duty T100a).

IEC 60694 covered common matters for equipment falling under the responsibility of subcommittees IEC SC 17A and SC 17C, such as circuit-breakers, disconnectors and earthing switches, switches and their combinations with other equipment, gas-insulated substations, etc. Mainly, these specifications concerned normal and special service conditions, ratings and tests on dielectric withstand, normal and short-circuit current carrying auxiliary and control circuits, and common rules for design and construction. The first edition had 78 pages.

The experience with this standard on common specifications was very positive. Therefore, when the decision was made to revise IEC 694 this was largely to take into account items which had not been covered by standards, so far. Very little had to be changed or updated in the existing clauses of the first edition. This second edition with title "Common specifications for high-voltage switchgear and controlgear" published in 1996 with reference IEC 60694, has, among others, additional chapters which deal with safety aspects of electrical, mechanical, thermal and operational nature. This had, in particular, consequences for the rules for design and construction as well as tests which now, also, covered topics such as interlocking, position indication, degree of protection by enclosures and tightness. A new and important item that was introduced was electromagnetic compatibility (EMC). Naturally, service and test experiences which had been gathered on the basis of the first edition reflected in the revision. For example, the number of test specimen became limited, the conditions for identification of the test object became more pronounced, and the criteria to pass the test were written in a more exact manner.

The second edition of IEC 60694 was revised and published in 2007 as the first edition of IEC 62271-1.

Manufacturers, users and test laboratories recognize that the reliability of high-voltage switchgear is of crucial importance for the safety and availability of the supply of electric energy. The overall high level of reliability and performance which is common today has its roots in the very good quality of the standards for high-voltage switchgear and controlgear. They are continuously updated to reflect the actual status of the respective technologies.

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IEC 62271-1:2007, *High-voltage switchgear and controlgear – Part 1: Common specifications*

IEC 62271-4, *High-voltage switchgear and controlgear – Part 4: Handling procedures for sulphur Hexafluoride (SF_6)* [2]

IEC 62271-100:2008, *High-voltage switchgear and controlgear – Part 100: Alternating-current circuit-breakers*
Amendment 1:2012
Amendment 2:2017

IEC 62271-101:2012, *High-voltage switchgear and controlgear – Part 101: Synthetic testing*

IEC 62271-102:2001, *High-voltage switchgear and controlgear – Part 102: Alternating current dosconnectors and earthing switches*

IEC 62271-110:2012, *High-voltage switchgear and controlgear – Part 110: Inductive load switching*

IEC 62271-310, *High-voltage switchgear and controlgear – Part 310: Electrical endurance testing for circuit-breakers above a rated voltage of 52 kV*

2 Evolution of IEC standards for high-voltage circuit-breaker

Questions arise frequently concerning the basis and interpretation of standards IEC 62271-100 and IEC 62271-1. In most cases, these questions were due to a lack of background knowledge of the values and requirements laid down in these standards.

A selected number of reference textbooks is listed in the Bibliography. It must be remembered that the technology of high-voltage circuit-breakers is continuously progressing and will continue to do so in the future. Therefore, it is advisable to use such textbooks primarily as a source of information on network behaviour, such as switching conditions, transients, etc., and not for switchgear design.

As the installation of standard equipment in general is more economical than special designs, the application guide will help the utility and industrial engineers in the selection of the appropriate ratings to conform to their needs and specifications. It will enable them to judge which rating is necessary when specifying their circuit-breakers. This should take into account that in future high-voltage networks which will be worked harder and closer to their limits and that high-voltage circuit-breakers of present day technology are designed and procured for a lifetime of several decades. It is recognised that certain conditions may necessitate

[1] To be published.

[2] To be published.

requirements which are outside the circuit-breaker standards. In such cases, the technical report will help to specify the various ratings or possible additional testing to verify the suitability of the circuit-breaker for a specific application or condition.

Standards should be written fit for purpose, i.e. they should reflect general system requirements to ensure that the installed equipment works properly. Although it is recognised that not 100 % of all conditions occurring in service can be covered, long term experience with high-voltage switchgear standards shows that system conditions are generally covered adequately. Nevertheless, the feedback from service and new developments in equipment and networks must be taken into account in their revision, making standardization an ongoing process. This technical report will be a forum to provide the necessary information concerning the background of changes in the standards.

Technical specification aspects are not generally considered in standards. However, this application guide will address such aspects where appropriate.

As high-voltage transmission and distribution systems and high-voltage circuit-breakers developed it was found necessary to provide standards for circuit-breakers, first on national basis. For example, already in 1923 the first edition of the British Standard B.S.S. No. 116 for circuit-breakers was issued.

In the late 1920s it was recognized that an international agreement should be obtained for a specification for high-voltage circuit-breakers, particularly with respect to their behaviour under short-circuit condition. This lead to the establishment of the "IEC Advisory Committee No. 17" which met for the first time in Stockholm in 1930 and drafted some preliminary recommendations on the international standardization of circuit-breakers.

After a series of specially convened meetings the first IEC Specification No. 56 for Alternating-Current Circuit-Breakers, Chapter I, Rules for Short-Circuit Conditions, was issued in the summer of 1937, with international approval and recognition as a basis upon which to establish national specifications. The first edition of IEC 56 was bilingual and consisted of 55 pages.

Also at that time, already, the need was seen to have Certificates of Ratings issued by approved Testing Authorities to confirm the compliance with Standard Specifications.

The second world war interrupted the further work on the IEC circuit-breaker standards. In 1954 the second edition was published which used and continued the concept of the first edition. It was intended that the IEC Specification No. 56 should ultimately incorporate five chapters which were to be discussed in the following order:

Chapter I	Rules for short-circuit conditions.
	First edition of Publication 56 to be revised and enlarged in a second edition.
Chapter II	Rules for normal-load conditions.
	Part 1 – Rules for temperature-rise.
	Part 2 – Rules for operating conditions.
Chapter III	Rules for strength of Insulation.
Chapter IV	Rules for the selection of circuit-breakers for service.
Chapter V	Rules for the maintenance of circuit-breakers in service.

Actually, the second edition, as the first one, did not progress beyond Chapter I. It was bilingual and had a total of 77 pages. According to its scope it covered a.c. circuit-breakers of 1 000 V and above.

Some major features were:

– the breaking capacity was expressed in MVA by 2 values, one for a symmetrical and the other for an asymmetrical breaking current;

– the TRV, defined as "restriking voltage", was of single frequency. The amplitude factor or crest value and the TRV frequency or rate-of-rise were not specified but to be evaluated in the tests;

– the first-pole-to-clear factor in general was 1,5. However, in a note allowance was made to use 1,3 for circuit-breakers for earthed systems;

– 50 Hz and 60 Hz were no problem, as for making and breaking tests the tolerance of the frequency was ±25 %;

– the short-circuit current breaking tests consisted of test-duties 1 to 5 with 10 %, 30 %, 60 % and 100 % of the rated symmetrical and the rated asymmetrical breaking current.

Edition 3 was issued in 1971 with a new structure. It applied to high-voltage a.c. circuit-breakers rated above 1 000 V and had six parts which were published as separate booklets:

Publication 56-1:	Part 1: General and definitions.
Publication 56-2:	Part 2: Rating.
Publication 56-3:	Part 3: Design and construction.
Publication 56-4:	Part 4: Type tests and routine tests.
Publication 56-5:	Part 5: Rules for the selection of circuit-breakers for service.
Publication 56-6:	Part 6: Information to be given with enquiries, tenders and orders and rules for transport, erection and maintenance.

IEC 56 consisted of 294 pages when it was issued, but over the years a large number of amendments was added. Out-of-phase was covered by its own publication, IEC 267.

The third edition was the first comprehensive IEC Standard on high-voltage circuit-breakers meeting the originally intended goals. It included, also, the general requirements which are now compiled in IEC 62271-1.

Compared to the second edition a large number of changes were introduced:

– for the first time mechanical tests, tests on insulation properties, tests on auxiliary and control circuits, temperature rise tests, etc., were specified;

– the R 10 series is used for rated normal and breaking currents;

– the TRV (first time to use this term) representation by two or four parameters and the definitions as used up to today are installed;

– for rated voltages up to 100 kV the first-pole to clear factor is 1,5, for 123 kV and above it is alternatively 1,3 or 1,5;

– the supply side rate-of-rise of TRV for 123 kV and above for terminal fault is 1,0 kV/μs for TD 4, 2,0 kV/μs for TD 3 and 5,0 kV/μs for TD 2;

– the short-line fault is introduced. The specified surge impedance is 480 Ω for lines with 1 conductor/phase (52 – 245 kV < 40 kA), 375 Ω for 2 conductors/phase and 330 Ω for 3 or 4 conductors per phase. The line side peak factor is 1,7, 1,6, or 1,5, respectively. The source side rate-of-rise is 0,67 kV/μs;

– test for capacitive current switching (line and cable charging, single capacitors) are prescribed;

– not only type tests, but also routine test procedures are defined.

Edition 4 of IEC 56, published 1987, followed the scheme of the 3rd edition. However, to avoid a duplication of requirements in the various standards for high-voltage switching equipment, IEC 56 was reduced to those requirements that were specific for high-voltage a.c. circuit-breakers. The "common clauses for high-voltage switchgear and controlgear" was published as a separate standard in 1980 with reference number IEC 694.

Edition 4 of IEC 60056 consisted of one book of 329 pages. To conform with actual service conditions some major changes were incorporated:

– as all systems rated 245 kV and higher are effectively earthed only a first-pole-to-clear factor 1,3 is specified for these voltage levels. For 100 kV to 170 kV alternatives 1,3 and 1,5 are specified;
– based on a large number of network investigations the supply side rate-of-rise of TRV is increased to 2,0 kV/μs for 100 %, 3,0 kV/μs for 60 % and 5,0 kV/μs for 30 % rated breaking current;
– to take into account the clashing of the conductors of a line phase due to the forces of the short-circuit current, which makes it similar to a single conductor, a uniform surge impedance of 450 Ω is specified for all short-line fault tests. The line side peak value is 1,6, the supply side rate-of-rise 2,0 kV/μs;
– the initial Transient Recovery Voltage (ITRV) is introduced for rated voltages of and above 100 kV;
– out-of-phase specifications are included;
– to prove that capacitive current breaking is performed without restrikes the number of tests per duty is increased;
– also, the number of operations during mechanical type tests is increased from 1 000 to 2 000.

And still, IEC 60056 continued to grow. The 4th edition was revised, resulting in the first edition of IEC 62271-100 published in 2001. The first edition of IEC 62271-100 had 575 pages. The structure of the document was retained but its content was revised taking into account service experience and requirements by the utilities:

– classifications of circuit-breaker are introduced with respect to mechanical and (for medium voltage) electrical endurance and restrike behaviour when switching capacitive loads;
– more severe test conditions are prescribed for circuit-breakers to prove a very low probability of restrikes in capacitive current switching;
– for type tests the number of test specimen is limited;
– some test procedures are prescribed in more detail;
– critical current tests and single-phase and double-earth fault tests are treated in particular;
– tolerances are given on practically all test quantities during type tests;
– special cases time constants, longer than 45 ms, are specified for the different levels of rated voltages.

The first edition of IEC 62271-100 was revised and the second edition was published in 2008. The following major changes were made:

– the introduction of harmonised (IEC and IEEE) TRV waveshapes for rated voltages of 100 kV and above (amendment 1 to the first edition);
– the introduction of cable and line systems with their associated TRVs for rated voltages below 100 kV (amendment 2 to the first edition);
– the inclusion of IEC 61633 (Guide for short-circuit and switching tests procedures for metal enclosed and dead tank circuit-breakers) and IEC 62271-308 (Guide for asymmetrical short-circuit breaking test duty T100a).

IEC 60694 covered common matters for equipment falling under the responsibility of subcommittees IEC SC 17A and SC 17C, such as circuit-breakers, disconnectors and earthing switches, switches and their combinations with other equipment, gas-insulated substations, etc. Mainly, these specifications concerned normal and special service conditions, ratings and tests on dielectric withstand, normal and short-circuit current carrying auxiliary and control circuits, and common rules for design and construction. The first edition had 78 pages.

The experience with this standard on common specifications was very positive. Therefore, when the decision was made to revise IEC 694 this was largely to take into account items which had not been covered by standards, so far. Very little had to be changed or updated in the existing clauses of the first edition. This second edition with title "Common specifications for high-voltage switchgear and controlgear" published in 1996 with reference IEC 60694, has, among others, additional chapters which deal with safety aspects of electrical, mechanical, thermal and operational nature. This had, in particular, consequences for the rules for design and construction as well as tests which now, also, covered topics such as interlocking, position indication, degree of protection by enclosures and tightness. A new and important item that was introduced was electromagnetic compatibility (EMC). Naturally, service and test experiences which had been gathered on the basis of the first edition reflected in the revision. For example, the number of test specimen became limited, the conditions for identification of the test object became more pronounced, and the criteria to pass the test were written in a more exact manner.

The second edition of IEC 60694 was revised and published in 2007 as the first edition of IEC 62271-1.

Manufacturers, users and test laboratories recognize that the reliability of high-voltage switchgear is of crucial importance for the safety and availability of the supply of electric energy. The overall high level of reliability and performance which is common today has its roots in the very good quality of the standards for high-voltage switchgear and controlgear. They are continuously updated to reflect the actual status of the respective technologies.