

A. I. E. E.
No. 19
June-1943

Standards

for

ALTERNATING-CURRENT
POWER CIRCUIT BREAKERS

(Supercedes A. I. E. E. Standard No. 19-1938)



Published by
THE AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS
33 West Thirty-ninth Street, New York

ACKNOWLEDGEMENT

The Institute wishes to acknowledge its indebtedness to those who have so freely given their time and knowledge and have conducted experimental work on which many of the A. I. E. E. Standards are based.

In the development of this standard full credit is extended to the A. I. E. E. Committee on Protective Devices, Subcommittee on Circuit Breakers, Switches and Fuses.

Development of the Standards of the American Institute of Electrical Engineers

Recognizing the importance in the development of electrical engineering, of standardization in the electrical field, the A.I.E.E. in 1898 appointed a Committee on Standardization, consisting of seven members having qualifications and experience from designing, manufacturing and operating standpoints. The report of this Committee was accepted at a meeting of the Institute in June 1899.

Experience gained in applications of the standards and further developments in electrical apparatus and methods showed the necessity of revision, and a committee was appointed which after consultation with manufacturing and operating engineers presented the first revised report on Standardization Rules of the A.I.E.E. in June 1902.

The next revision was undertaken by a committee of ten, which presented its report in May 1906.

In September 1906, a Standards Committee of eleven members was appointed for further revision, and its report was presented in June 1907.

The appreciation of the importance and value of standardization resulted in the formation of a Standing Committee, with the title of Standards Committee of the A.I.E.E. This became effective in the Constitution of June 1907. The scope and amount of work necessitated increasing the number of members from time to time until in 1922 there were 37 members divided into a number of subcommittees specializing on various subjects.

A.I.E.E. Standards published in a single volume as each revision was adopted were generally accepted as Standards of the electrical industry of the United States since the adoption of the first report in 1899. Subsequent reports on Standards were made and published, in some cases in several editions. The dates of adoption by the Board of Directors of such reports are as follows: June 20, 1902; June 21, 1907; June 27, 1912; July 10, 1914; June 30, 1915; June 28, 1916; November 8, 1918; October 8, 1920, and June 29, 1922.

On June 29, 1922, in view of the increasing complexity of the work, a reorganization of the Standards Committee was effected, and a working organization established which provided for an increase in standardization work and for the appointment on Working Committees of the Standards Committee of non-Institute members.

The present plan under which the Institute Standards are being issued involves the separation of the complete body of Standards into more than forty sections, each published as a separate pamphlet and dealing with a specific subject. Each section of the Standards has been formulated either by a Working Committee of the Standards Committee which was made as representative as possible for the work in hand, by an A.I.E.E. technical committee or subcommittee, or by a Sectional Committee organized according to the procedure of the American Standards Association. The division of the Standards into a number of separate publications simplifies the process of keeping the standards revised to conform with the latest development and enables those interested in a particular field to obtain in concise form the material relating to that field. In framing the Institute Standards the chief purpose has been to define terms and conditions which characterize the rating and behavior of electrical machinery and apparatus, with special reference to the conditions of acceptance tests.

This revision of A.I.E.E. Standard No. 19 was developed under the auspices of the Protective Devices Committee of the Institute, Subcommittee on Circuit Breakers, Switches and Fuses. It was approved by the Board of Directors on May 27, 1943.

The A.I.E.E. Standards Committee takes this occasion to draw attention to the value of suggestions based upon experience gained in the application of the Standards to general practise. Any suggestions looking toward improvement in the Standards will be welcomed for the guidance of the Committee in preparation of future editions, and should be communicated to the Secretary of the A.I.E.E. Standards Committee, 33 West 39th Street, New York.

STANDARDS

FOR

Alternating-Current Power Circuit Breakers

(Adopted by the A.I.E.E. Board of Directors March 29, 1938. Revised May 27, 1943.)

SCOPE

These standards apply to all indoor and outdoor types of alternating-current power circuit breakers rated in excess of 600 volts.

SERVICE CONDITIONS

19-1 Usual Service Conditions.—Power circuit breakers conforming to these standards shall be suitable for operating at their standard ratings.

- (a) Where the temperature of the cooling medium does not exceed 40 C if the circuit breakers have copper to copper contacts or equivalent.
- (b) Where the temperature of the cooling medium does not exceed 55 C if the circuit breakers have all conducting joints, including terminal connections, soldered or silver surfaced and separately held mechanically, or brazed, welded, or silver soldered, and all contacts silver surfaced or equivalent.
- (c) Where the altitude does not exceed 3300 ft. (1000 meters).

19-2 Unusual Service Conditions. The use of apparatus in cooling media having temperatures higher than as specified in 19-1, or at altitudes greater than 3300 ft. (1000 meters) shall be considered as special.

Voltage and current ratings: For applications at altitudes greater than 3300 ft. (1000 meters), it is recommended that the standard voltage and current ratings of the apparatus should be multiplied by the following factors to obtain the modified ratings:

Altitude in Feet	Correction Factors	
	Voltage	Current
3300 (1000 meters)	1.00	1.00
4000 (1200 meters)	0.98	0.996
5000 (1500 meters)	0.95	0.99
10000 (3000 meters)	0.80	0.96

19-3 Conditions Affecting Construction or Protecting Features.—There are further unusual

conditions which, where they exist, should receive special consideration. Such conditions should be brought to the attention of those responsible for the application, manufacture, and operation of the equipment. Apparatus for use in such cases may require special construction or protection. Among such unusual conditions are:

- (a) Exposure to damaging fumes or vapors, excessive or abrasive dust, explosive mixtures of dust or gases, steam, salt spray, excessive moisture or dripping water, etc.
- (b) Exposure to abnormal vibration, shocks, or tilting.
- (c) Exposure to excessively high or low temperatures.
- (d) Exposure to unusual transportation or storage conditions.
- (e) Unusual space limitations.
- (f) Unusual operating duty, frequency of operation, difficulty of maintenance, etc.

DEFINITIONS

Definitions as given herein apply specifically to the apparatus treated in these standards. For additional definitions, see American Standard Definitions of Electrical Terms—C42. The three-part numbers in parentheses following the titles of some of the definitions included in these standards indicate the number of the corresponding definitions in C42.

General

19-50 Circuit Breaker. (20.15.005)—A circuit breaker is a device for interrupting a circuit between separable contacts under normal or abnormal conditions. Ordinarily, circuit breakers are required to operate only infrequently, although some classes of breakers are suitable for frequent operation.

Note: Normal indicates the interruption of currents not in excess of the rated continuous current of the circuit breakers. Abnormal indicates the interruption of currents in excess of such rated continuous current such as, short-circuits. In application, circuit breakers are selected whose rated interrupting current is as great or greater than the maximum current which they may be called upon to interrupt.

19-51 Oil Circuit Breaker. (20.15.010)—An oil circuit breaker is a circuit breaker in which the interruption occurs in oil.

19-52 Air Circuit Breaker. (20.15.015)—An air circuit breaker is a circuit breaker in which the interruption occurs in air.

19-53 Power Circuit Breaker. (Not in C42)—For the purpose of this standard, power circuit breakers comprise alternating-current circuit breakers as follows:

- (a) Oil circuit breakers rated in excess of 600 volts.
- (b) Air circuit breakers rated in excess of 600 volts.
- (c) Circuit breakers using liquids other than oil and rated in excess of 600 volts.

19-54 Operating Voltage. (20.05.171)—The operating voltage of a circuit breaker is the rms voltage of the system on which it is to be operated.

19-55 Recovery Voltage. (Not in C42)—Recovery voltage is the voltage impressed upon a circuit-interrupting device after the current has been interrupted.

- (a) **Normal Frequency Recovery Voltage. (20.05.172)**. The normal frequency recovery voltage is the normal frequency rms voltage impressed upon a circuit-interrupting device after the current has been interrupted and after high-frequency transients have subsided.

For determination of the normal frequency recovery voltage, see Proposed American Recommended Practice—C37.5, Methods for Determining the Rms Value of a Sinusoidal Current Wave and a Normal Frequency Recovery Voltage.

- (b) **Transient Recovery Voltage. (20.05.173)**. The transient recovery voltage is the transient voltage which occurs across the terminals of a circuit-interrupting device at the time of arc extinction. In a multi-pole interrupting device, it is usually applied to the voltage across the first pole to clear.
- (1) **Circuit Transient Recovery Voltage.* (Not in C42)**. The circuit transient recovery voltage is the transient recovery voltage of a circuit. It is based on 100 per cent normal frequency recovery voltage, symmetrical currents, and the introduction of no

*The transient voltage used in the above definitions refers to the varying voltage that occurs at about the time of arc extinction, appearing and disappearing usually within a fraction of a cycle.

distortion by the circuit-interrupting device. This voltage indicates the inherent severity of the circuit with respect to recovery voltage phenomena.

- (2) **Modified Circuit Transient Recovery Voltage.* (Not in C42)**. The modified circuit transient recovery voltage is the circuit transient recovery voltage modified in accordance with the normal frequency recovery voltage and a symmetry of the current wave obtained on a particular test. This voltage indicates the severity of the particular test with respect to recovery voltage phenomena.
- (3) **Test Transient Recovery Voltage.* Not in C42**. The test transient recovery voltage is the transient recovery voltage which actually occurs across the circuit-interrupting device contacts on an individual test. This is the modified circuit transient recovery voltage with whatever distortion may be introduced by the circuit interrupting device.
- (c) **Transient Recovery Voltage Rate. (20.05-174)**—The transient recovery voltage rate is the rate at which voltage rises across the contacts of a circuit-interrupting device at the time of arc extinction. It is usually measured as the slope of a line passing through zero voltage at the instant of arc current zero and thence through one of the peaks of the curve describing the transient recovery voltage. In case the transient recovery voltage curve does not have any definite or salient peaks, the line is drawn through some arbitrarily chosen point usually selected as a certain percentage of the crest value of the normal frequency recovery voltage at which the test is made. For determination of transient recovery voltage rates, see Proposed American Recommended Practice—C37.9, Test Code for Oil Circuit Breakers.

Construction

19-56 Arcing Contacts. (20.10.285)—Arcing contacts are the contacts on which the arc is drawn after the main contacts of a switch or circuit breaker have parted.

19-57 Auxiliary Switch. (20.10.080)—An auxiliary switch is a switch actuated by some main device such as a circuit breaker, for signalling, interlocking, or other purpose.

As applied to circuit breakers, an auxiliary switch is designated as "a" (usually shown on drawings as normally open) if it is closed when the circuit breaker is closed, or as "b" (usually