

# Australian Standard 2006—1977

---

## HIGH VOLTAGE ALTERNATING CURRENT CIRCUIT-BREAKERS

---



STANDARDS ASSOCIATION OF AUSTRALIA  
*Incorporated by Royal Charter*

THE FOLLOWING SCIENTIFIC, INDUSTRIAL AND GOVERNMENTAL organizations were officially represented on the committee entrusted with the preparation of this standard:

Associated Chambers of Manufactures of Australia  
Australian British Trade Association  
Australian Electrical Manufacturers Association  
Electricity Supply Association of Australia  
Electricity Supply Engineers Association of N.S.W.  
Railways of Australia Committee  
Testing Authorities  
The Institution of Engineers, Australia

---

This standard, prepared by Committee EL/7, Power Switchgear, was approved on behalf of the Council of the Standards Association of Australia on 13 December 1976, and was published on 1 July 1977.

To keep abreast of progress in industry, Australian standards are regularly reviewed. Suggestions for improvement to published standards, addressed to the head office of the Association, are welcomed.

---

*This standard was issued in draft form for public review as DR 74185.*

AUSTRALIAN STANDARD SPECIFICATION

# HIGH VOLTAGE ALTERNATING CURRENT CIRCUIT-BREAKERS

AS 2006—1977

First published (as AS C89, being endorsement of BS 116: 1952 with Australian amendment; and AS C380, being endorsement of BS 3659: 1963 with Australian amendment) .... 1967
Revised and issued as AS 2006 .... .... 1977

PUBLISHED BY THE STANDARDS ASSOCIATION OF AUSTRALIA  
STANDARDS HOUSE, 80 ARTHUR STREET, NORTH SYDNEY, N.S.W.

ISBN 0 7262 1171 0

## P R E F A C E

This standard was prepared by a sub-committee of the Association's Committee on Power Switchgear as a revision of AS C89-1967 and AS C380-1967, which it accordingly supersedes.

In the preparation of the standard, reference was made to the following publications of the International Electrotechnical Commission and acknowledgment is made of the assistance received therefrom:

- IEC 56 High Voltage Alternating Current Circuit-breakers
- IEC 56-1: Part 1—General and Definitions
- IEC 56-2: Part 2—Rating
- IEC 56-3: Part 3—Design and Construction
- IEC 56-4: Part 4—Type Tests and Routine Tests
- IEC 56-4A: Part 4—Appendix E: Methods of Determining Prospective Transient Recovery Voltage Waves
- IEC 56-5: Part 5—Rules for Selection of Circuit-breakers for Service
- IEC 56-6: Part 6—Information to be given with Enquiries, Tenders and Orders and Rules for Transport, Erection and Maintenance
- IEC 267 Guide to the Testing of Circuit-breakers with Respect to Out-of-phase Switching.

This standard is generally based on the above publications; however, while IEC 56 is published as a number of separate parts, they are all included herein under one cover. Sections 1 to 4 of this standard correspond to Parts 1 to 4 of IEC 56. In these Sections the sequence of the clauses corresponds to the relevant IEC publication but the clause numbers have been changed to comply with SAA editorial practice. Section 5, covering routine tests, is based on Section 2 of IEC 56-4.

This standard also includes appendices based on IEC 56, Parts 5 and 6, and on appendices to the various Parts of IEC 56. The origin of appendices based on IEC work is given as a footnote to the title of the appendix concerned.

Where this standard deviates technically from the IEC documents, by way of additional or different requirements, this fact is indicated by a rule in the margin against the clause, or part thereof, affected.

Because of the number of changes involved in this standard compared with the previous standards AS C89 and AS C380, particularly in regard to ratings, it is recognized that a period of time will elapse before circuit-breakers meeting these requirements become available.

The issue of this standard is not intended to invalidate existing test certificates nor does it necessarily mean that circuit-breakers tested in accordance with the previous standards are unsuitable for use in systems.

It is recommended that purchaser's specifications allow the alternative of equipment certified to the previous standards over a period of about three years from the date of publication of this new standard. Furthermore, it is anticipated that some system designs will continue for some time to utilize fault levels to the previous standards until equipment to this standard becomes more widely available.

In the application of the standard, reference may be necessary to the following standards:

- AS 1052 Electromagnetic Interference Measuring Equipment  
Part 2—Equipment for the Frequency Range 0.15 MHz to 1000 MHz
- AS 1265 Bushings for Alternating Voltages above 1000 V
- AS 1675 Current Transformers for Measurement and Protection
- AS 1824 Insulation Co-ordination  
Part 1—Basic Principles, Standard Insulation Levels and Test Procedures
- AS 1931 High Voltage Testing Techniques  
Part 1—General Definitions, Test Requirements, Test Procedures and Measuring Devices
- AS C1 Standard Voltages and Frequency for A.C. Transmission and Distribution Systems
- AS C320 Classification of Insulating Materials for Electrical Machinery and Apparatus on the Basis of Thermal Stability in Service
- IEC 427 Report on Synthetic Testing of High-voltage Alternating Current Circuit-breakers.

© Copyright — STANDARDS ASSOCIATION OF AUSTRALIA 1977

Users of standards are reminded that copyright subsists in all SAA publications. No part of this publication may be reproduced, stored in a retrieval system in any form or transmitted by any means without prior permission in writing of the Standards Association of Australia.

## CONTENTS

	<i>Page</i>
SECTION 1. SCOPE, SERVICE CONDITIONS AND DEFINITIONS	
1.1 Scope .....	7
1.2 Service Conditions .....	8
1.3 Definitions .....	8
SECTION 2. RATINGS	
2.1 Rated Characteristics .....	24
2.2 Rated Voltage .....	25
2.3 Rated Insulation Level .....	25
2.4 Rated Frequency .....	26
2.5 Rated Normal Current .....	27
2.6 Rated Short-circuit Breaking Current .....	27
2.7 Rated Transient Recovery Voltage for Terminal Faults	31
2.8 Rated Characteristics for Short-line Faults .....	38
2.9 Rated Short-circuit Making Current .....	38
2.10 Rated Duration of Short-circuit .....	41
2.11 Rated Operating Sequence .....	41
2.12 Rated Out-of-Phase Breaking Current .....	41
2.13 Rated Line-charging Breaking Current .....	42
2.14 Rated Cable-charging Breaking Current .....	42
2.15 Rated Capacitor Breaking Current .....	43
2.16 Rated Small Inductive Breaking Current .....	44
2.17 Rated Supply Voltages of Closing and Opening Devices	44
2.18 Rated Supply Voltages of Auxiliary Circuits .....	44
2.19 Rated Supply Frequency of Closing and Opening Devices and of Auxiliary Circuits .....	44
2.20 Rated Pressure of Compressed Gas Supply for Operation or Interruption or Insulation .....	45
2.21 Coordination of Rated Values .....	45
2.22 Rated Mechanical Terminal Load .....	45
SECTION 3. DESIGN AND CONSTRUCTION	
3.1 Requirements for Liquids and Gases in Circuit- breakers .....	48
3.2 Requirements for Simultaneity of Poles .....	48
3.3 Auxiliary Equipment .....	48

	<i>Page</i>
3.4 General Requirements for Operation ....	49
3.5 Dependent Power Closing ....	49
3.6 Stored Energy Closing ....	49
3.7 Operation of Releases ....	50
3.8 Operation of Gas-blast Circuit-breakers ....	52
3.9 Low and High Pressure Interlocking Devices ....	52
3.10 Vent Outlets ....	52
3.11 Rating Plates ....	52
 <b>SECTION 4. TYPE TESTS</b>	
4.1 General ....	54
4.2 Mechanical Test ....	55
4.3 Temperature-rise Test ....	55
4.4 Dielectric Tests ....	58
4.5 Miscellaneous Provisions for Making and Breaking Tests ....	71
4.6 Test Circuits for Short-circuit Making and Breaking Tests ....	79
4.7 Short-circuit Test Quantities ....	85
4.8 Short-circuit Test Procedure ....	99
4.9 Basic Short-circuit Test Duties ....	100
4.10 Critical Current Tests ....	102
4.11 Single-phase Short-circuit Tests ....	102
4.12 Short-line Fault Tests ....	103
4.13 Out-of-phase Switching Tests ....	106
4.14 Short-time Current Test ....	109
4.15 Line-charging Current Breaking Tests ....	111
4.16 Cable-charging Current Breaking Tests ....	114
4.17 Capacitor Bank Breaking Tests ....	117
4.18 Small Inductive Current Breaking Tests ....	120
4.19 Evolving-fault and Parallel Breaking Tests ....	120
 <b>SECTION 5. ROUTINE TESTS</b>	
5.1 General ....	121
5.2 Power Frequency Tests on the Main Circuit ....	121
5.3 Voltage Tests on Control and Auxiliary Circuits ....	122
5.4 Measurement of the Resistance of the Main Circuit ....	122
5.5 Mechanical Operating Tests ....	122

	<i>Page</i>
<b>APPENDICES</b>	
A	Guide to the Selection of Circuit-breakers for Service 124
B	Information to be given with Enquiries, Tenders and Orders ..... 131
C	Rules for Transport, Erection and Maintenance ..... 135
D	Records and Reports of Type Tests for Making, Breaking and Short-time Current Performance ..... 138
E	Determination of the Equivalent RMS Value of a Short-time Current During a Short-circuit of a Given Duration ..... 142
F	Determination of Short-circuit Power Factor ..... 144
G	Calculation of Specified Transient Recovery Voltages for Short-line Faults from Rated Characteristics and for Short-line Tests ..... 147
H	Method of Drawing the Envelope of the Prospective Transient Recovery Voltage of a Circuit and Determining the Representative Parameters ..... 155
J	Methods of Determining Prospective Transient Recovery Voltage Waves ..... 159
K	Alternative Standard Values of Prospective TRV for Test Duties 4 and 5 and for Test Duty 3, Representation by 2 Parameters ..... 179
L	Calculation of Atmospheric Correction Factors for Dielectric Tests ..... 181

## STANDARDS ASSOCIATION OF AUSTRALIA

---

**Australian Standard Specification  
for  
HIGH VOLTAGE ALTERNATING CURRENT  
CIRCUIT-BREAKERS**

---

## SECTION 1.

## SCOPE, SERVICE CONDITIONS AND DEFINITIONS

**1.1 SCOPE.** This standard applies to a.c. circuit-breakers designed for indoor and outdoor installation and for operation at frequencies up to and including 60 Hz on systems having voltages above 1000 V, and to the operating devices of circuit-breakers and to their auxiliary equipment.

It applies only to three-pole circuit-breakers for use in three-phase systems and single-pole circuit-breakers for use in single-phase systems. Two-pole circuit-breakers for use in single-phase systems are subject to agreement between purchaser and manufacturer.

The switching in an out-of-phase condition and the switching of overhead lines, cables and single capacitor banks in normal conditions are covered, the applicability of tests for these operations being indicated in Clauses 4.13.1, 4.15.1, 4.16.1 and 4.17.1.

NOTE: Tests to prove the performance of a circuit-breaker in the switching of overhead lines, cables or single capacitor banks under fault and other abnormal conditions should be subject to agreement between the purchaser and the manufacturer. Such other abnormal conditions are, for instance, cases where the voltage is higher than the rated voltage of the circuit-breaker, conditions which may occur due to sudden loss of load on long lines or cables.

This standard does not apply to the following:

- (a) Circuit-breakers intended for use on motive power units of electrical traction equipment.
- (b) Circuit-breakers intended for use with overhead lines which include series capacitors.
- (c) Starting switches, contactors, tap-switches and similar apparatus.
- (d) Circuit-breakers with closing mechanisms for dependent manual operation, because in such cases rated short-circuit making-current cannot be guaranteed and such dependent manual operation may be objectionable because of safety reasons.

This standard does not necessarily apply to circuit-breakers for special conditions of service, e.g. those produced by two earth faults one of which occurs on one side of the circuit-breaker and the other on another phase on the other side of the circuit-breaker.