

Australian Standard<sup>®</sup>

---

**High-voltage test techniques**

**Part 2: Measuring systems**

---

This Australian Standard was prepared by Committee EL/7, Power Switchgear. It was approved on behalf of the Council of Standards Australia on 10 November 1995 and published on 5 March 1996.

---

The following interests are represented on Committee EL/7:

Australian British Chamber of Commerce  
Australian Chamber of Commerce and Industry  
Australian Electrical and Electronic Manufacturers Association  
Electricity Supply Association of Australia  
Institution of Engineers, Australia  
Railways of Australia  
Testing Interests, Australia  
WorkCover Authority of N.S.W.

---

**Review of Australian Standards.** To keep abreast of progress in industry, Australian Standards are subject to periodic review and are kept up to date by the issue of amendments or new editions as necessary. It is important therefore that Standards users ensure that they are in possession of the latest edition, and any amendments thereto.

Full details of all Australian Standards and related publications will be found in the Standards Australia Catalogue of Publications; this information is supplemented each month by the magazine 'The Australian Standard', which subscribing members receive, and which gives details of new publications, new editions and amendments, and of withdrawn Standards.

Suggestions for improvements to Australian Standards, addressed to the head office of Standards Australia, are welcomed. Notification of any inaccuracy or ambiguity found in an Australian Standard should be made without delay in order that the matter may be investigated and appropriate action taken.

---

*This Standard was issued in draft form for comment as DR 95213.*

Australian Standard<sup>®</sup>

---

**High-voltage test techniques**

**Part 2: Measuring systems**

---

## PREFACE

This Standard was prepared by the Joint Standards Australia/Standards New Zealand Committee EL/7 on Power Switchgear. It is identical with and has been reproduced from IEC 60-2:1994, *High-voltage test techniques*, Part 2: *Measuring systems*, to supersede AS 1931.2 — 1977, *High-voltage testing techniques*, Part 2: *Application guide for measuring devices*.

This Standard is the result of a consensus among representatives on the Joint Committee to produce it as an Australian Standard.

This Standard is Part 2 of AS 1931, *High-voltage test techniques*, which is published in Parts as follows:

- Part 1: General definitions and test requirements  
Part 2: Measuring systems

The objective of this Standard, in addition to that stated in Clause 1, is to bring the superseded Standard into line with IEC 60-2.

The terms ‘normative’ and ‘informative’ have been used in this Standard to define the application of the annexes to which they apply. A ‘normative’ annex is an integral part of a Standard, whereas an ‘informative’ annex is only for information and guidance.

As this Standard is reproduced from an international Standard, the following applies:

- Its number is shown only on the cover and title page, while the international Standard number appears only on the cover.
- In the source text, ‘this International Standard’ should read ‘this Australian Standard’.
- A full point substitutes for a comma when referring to a decimal marker.

References to international Standards should be replaced by equivalent Australian Standards, as follows:

<i>References to International Standard</i>			<i>Australian Standards</i>		
IEC			AS		
50	International	Electrotechnical	1852	International	Electrotechnical
	Vocabulary			Vocabulary	
50(301)	General terms on measurements in		1852.301	General terms on measurements in	
	electricity			electricity	
50(302)	Electrical measuring instruments		1852.302	Electrical measuring instruments	
50(303)	Electronic measuring instruments		1852.303	Electronic measuring instruments	
50(321)	Instrument transformers		1852.321	Instrument transformers	
51	Direct acting indicating analogue		—		
	electrical-measuring instruments and				
	their accessories				
52	Recommendations for voltage		2886	Voltage measurement— Sphere-	
	measurement by means of sphere-gaps			gap method (one sphere earthed)	
	(one sphere earthed)				
60	High-voltage test techniques		1931	High-voltage test techniques	
60-1	Part 1: General definitions and test		1931.1	Part 1: General definitions and	
	requirements			test requirements	
71	Insulation co-ordination		1824	Insulation co-ordination	
71-1	Part 1: Definitions, principles and		1824.1	Part 1: Definitions, principles and	
	rules			rules	

IEC 790	Oscilloscopes and peak voltmeters for impulse tests	AS —	
833	Measurement of power-frequency electric fields	3720	Measurement of power-frequency electric fields
1083	Digital recorders for measurements in high-voltage impulse tests	—	
1083.1	Part 1: Requirements for digital recorders		

Originated as AS 1931.2— 1977.  
Second edition 1996.

Incorporating:  
Amdt 1—1997

© Copyright — STANDARDS AUSTRALIA

Users of Standards are reminded that copyright subsists in all Standards Australia publications and software. Except where the Copyright Act allows and except where provided for below no publications or software produced by Standards Australia may be reproduced, stored in a retrieval system in any form or transmitted by any means without prior permission in writing from Standards Australia. Permission may be conditional on an appropriate royalty payment. Requests for permission and information on commercial software royalties should be directed to the head office of Standards Australia.

Standards Australia will permit up to 10 percent of the technical content pages of a Standard to be copied for use exclusively in-house by purchasers of the Standard without payment of a royalty or advice to Standards Australia.

Standards Australia will also permit the inclusion of its copyright material in computer software programs for no royalty payment provided such programs are used exclusively in-house by the creators of the programs.

Care should be taken to ensure that material used is from the current edition of the Standard and that it is updated whenever the Standard is amended or revised. The number and date of the Standard should therefore be clearly identified.

The use of material in print form or in computer software programs to be used commercially, with or without payment, or in commercial contracts is subject to the payment of a royalty. This policy may be varied by Standards Australia at any time.

## CONTENTS

Clause		Page
1	Scope .....	1
2	Normative references .....	2
3	Definitions and symbols .....	3
3.1	Measuring Systems .....	3
3.2	Converting devices .....	4
3.3	Transmission system .....	4
3.4	Indicating or recording instrument .....	4
3.5	Scale factors .....	5
3.6	Definition related to the dynamic behaviour of a Measuring System .....	5
3.7	Response parameters .....	6
3.8	Overall uncertainty $e$ .....	7
3.9	Rated values .....	8
3.10	Definitions related to tests .....	8
4	Procedures for qualification and use of measuring systems .....	9
4.1	General principles .....	9
4.2	Schedule of Performance Tests .....	9
4.3	Schedule of Performance Checks .....	10
4.4	Requirements for the Record of Performance .....	10
4.5	Operating conditions .....	11
5	Acceptance tests on components for an Approved Measuring System .....	12
5.1	Applicability .....	12
5.2	Determination of the scale factor .....	12
5.3	Linearity test .....	12
5.4	Short-term stability test .....	13
5.5	Long-term stability of single elements .....	13
5.6	Temperature effect .....	13
5.7	Proximity effect .....	13
5.8	Dynamic behaviour of a component .....	14
5.9	Withstand tests .....	14
6	Performance Tests on Measuring Systems .....	15
6.1	General requirements .....	15
6.2	Determination of the Assigned Scale Factor .....	16
6.3	Dynamic behaviour test (for Impulse Measuring Systems) .....	17
6.4	Interference test (for Impulse Measuring Systems) .....	17

Clause		Page
7	Measurement of direct voltage . . . . .	18
7.1	Requirements for an Approved Measuring System . . . . .	18
7.2	Acceptance tests on components for an Approved Measuring System . . . . .	18
7.3	Performance Test on Measuring Systems . . . . .	20
7.4	Performance Check . . . . .	20
7.5	IEC Standard Measuring Device . . . . .	20
7.6	Measurement of ripple amplitude . . . . .	20
8	Measurement of alternating voltage . . . . .	22
8.1	Requirements for an Approved Measuring System . . . . .	22
8.2	Acceptance tests on components for an Approved Measuring System . . . . .	22
8.3	Performance Test on Measuring Systems . . . . .	24
8.4	Performance Check . . . . .	24
8.5	IEC Standard Measuring Device . . . . .	24
9	Measurement of lighting impulse voltage . . . . .	25
9.1	Requirements for an Approved Measuring System . . . . .	25
9.2	Acceptance tests on components for an Approved Measuring System . . . . .	26
9.3	Performance Test on Measuring Systems . . . . .	28
9.4	Performance Check . . . . .	30
9.5	IEC Standard Measuring Device . . . . .	31
10	Measurement of switching impulse voltage . . . . .	32
10.1	Requirements for an Approved Measuring System . . . . .	32
10.2	Acceptance tests on components for an Approved Measuring System . . . . .	32
10.3	Performance Test on Measuring Systems . . . . .	34
10.4	Performance Check . . . . .	36
10.5	IEC Standard Measuring Device . . . . .	36
11	Measurement of impulse current . . . . .	37
11.1	Requirements for an Approved Measuring System . . . . .	37
11.2	Acceptance tests on components for an Approved Measuring System . . . . .	37
11.3	Performance Test on Measuring Systems . . . . .	38
11.4	Performance Check . . . . .	39
12	Reference Measuring Systems . . . . .	41
12.1	Requirements for Reference Measuring Systems . . . . .	41
12.2	Calibration of a Reference Measuring System . . . . .	41
12.3	Interval between successive Certifications of Reference Measuring Systems . . . . .	42

Clause	Page
Figures . . . . .	43
Annexes	
A Accreditation Systems . . . . .	46
A.1 National accreditation systems . . . . .	46
A.2 Bibliography . . . . .	47
B Structure of a Record of Performance . . . . .	48
B.1 General structure . . . . .	48
B.2 General description of the system (Chapter A) . . . . .	48
B.3 Acceptance test results on components (Chapter B) . . . . .	50
B.4 Routine test results on the complete Measuring System (Chapter C) . . . . .	50
B.5 Performance Test results (Chapter D) . . . . .	50
B.6 Performance Check (Chapter E) . . . . .	50
B.7 Minimal form of the Record of Performance . . . . .	51
C Step response measurements . . . . .	52
C.1 Circuits for step response measurements . . . . .	52
D Temperature rise of measuring resistors . . . . .	55
E Reference Measuring Systems and Comparison Measurements for Impulse Measurements—Bibliography . . . . .	56
E.1 Comparison measurements . . . . .	56
E.2 Some examples of dividers for Reference Measuring Systems . . . . .	56
E.3 IEC Standard measuring Devices . . . . .	56
F Summary of tests . . . . .	57
F.1 Tests on a direct voltage Measuring System . . . . .	58
F.2 Tests on an alternating voltage Measuring System . . . . .	59
F.3 Tests on a lightning impulse Measuring System . . . . .	60
F.4 Tests on a switching impulse Measuring System . . . . .	61
F.5 Tests on an impulse current Measuring System . . . . .	62
G Areas where special care is needed . . . . .	63
G.1 Measurement of the scale factor of a divider . . . . .	63
G.2 Probes and external attenuators . . . . .	63
G.3 Probe scale factor . . . . .	64
G.4 Use of appropriate levels . . . . .	64
G.5 Accuracy of time measurements . . . . .	64
H Procedure for estimating uncertainty in high-voltage measurements . . . . .	65



## AUSTRALIAN STANDARD

# HIGH-VOLTAGE TEST TECHNIQUES— Part 2: Measuring Systems

### 1 Scope

This part of IEC 60 is applicable to complete Measuring Systems, and to their components, used for the measurement of high-voltages and currents during tests with direct voltage, alternating voltage, lightning and switching impulse voltages and for tests with impulse currents, or with combinations of them as specified in IEC 60-1.

The limits on measurement uncertainties stated in this International Standard apply to test levels stated in IEC 71-1. The principles of this International Standard apply also to higher levels but the uncertainty may be greater.

This standard:

- defines the terms used,
- states the requirements which the Measuring Systems shall meet,
- describes the methods for approving a Measuring System and checking its components,
- describes the procedure by which the user will show that a Measuring System meets the requirements of this standard.