

Australian Standard[®]

**HIGH VOLTAGE A.C.
SWITCHGEAR AND
CONTROLGEAR—
DISCONNECTORS (ISOLATORS)
AND EARTHING SWITCHES**

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(Disconnectors and Earthing Switches, A.C. 1 kV and above)]

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PREFACE

This edition of this standard was prepared by the Association's Committee on Power Switchgear to supersede AS 1306—1977, High Voltage Isolators (Disconnectors) and Earthing Switches.

It applies to disconnectors (previously referred to as isolators), earthing switches and combinations of disconnectors and earthing switches designed for use indoors or outdoors on alternating current systems of rated voltages exceeding 1000 V.

This standard is based on IEC 129 and IEC document 17A(Central Office)162, which proposed the amendment of IEC 129 to line up with the IEC standard covering the common requirements for high-voltage a.c. switchgear and controlgear. Where this standard deviates technically from IEC 129, as amended by IEC document 17A(Central Office)162, this fact is indicated by a rule in the margin against the clause or part thereof affected and a summary of such deviations is given in the annex.

The appendices in this edition cover a procedure for arranging a pre-arcing condition when testing earthing switches for making capacity at reduced voltage, preferred nomenclature for types of disconnectors and earthing switches, and items subject to agreement between the purchaser and the manufacturer. Other matters which were dealt with in the appendices of the previous edition are now included in the body of this edition.

This edition reflects a substantial editorial rearrangement of the previous edition.

The clause numbering of this edition closely follows that of AS 2650 and where reference is made directly to clauses of the same number in AS 2650 without amendment thereto these clauses are shown in the Contents in bold. Clauses having numbers with a component part of 101 or greater are specific to this standard only.

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CONTENTS

NOTE: The listing of clauses in **bold** below indicates that those clauses in AS 2650 apply without amendment in this standard.

	<i>Page</i>
1. SCOPE AND GENERAL	
1.1 Scope	5
1.2 Application	5
1.3 Referenced Documents	5
2. SERVICE CONDITIONS	
3. DEFINITIONS	
3.1 General	5
3.101 General Terms	5
3.102 Switching Devices	5
3.103 Parts of Switching Devices	6
3.104 Characteristic Quantities	6
4. RATINGS	
4.0 List of ratings	6
4.1 Rated Voltage	7
4.2 Rated Insulation Level	7
4.3 Rated Frequency	7
4.4 Rated Normal Current and Temperature-rise	7
4.5 Rated Short-time Withstand Current	7
4.6 Rated Peak Withstand Current	7
4.7 Rated Duration of Short-circuit	7
4.8 Rated Supply Voltage of Closing and Opening Devices and Auxiliary Circuits	7
4.9 Rated Supply Frequency of Operating Devices and Auxiliary Circuits	7
4.10 Rated Pressure of Compressed Gas Supply for Operation	7
4.11 Rated Mechanical Load of Terminals	7
4.101 Rated Short-circuit Making Current	9
4.102 Rated Contact Zone	9
4.103 Rated Values of Maximum Force Required for Manual Operation	12
4.104 Behaviour when Carrying Rated Peak Withstand Current and Rated Short-time Withstand Current	12
4.105 Behaviour of Earthing Switches when Making Short-circuit Currents	12
4.106 Coordination of Rated Voltages, Rated Normal Currents, Rated Short-time Withstand Currents and Rated Peak Withstand Currents	12
5. DESIGN AND CONSTRUCTION	
5.1 Requirements for Liquids	12
5.2 Requirements for Gases	12
5.3 Earthing	14
5.4 Auxiliary Equipment	14
5.5 Dependent Power Closing—Opening	14
5.6 Stored Energy Closing—Opening	14
5.7 Operation of Releases	14
5.8 Low and High Pressure Interlocking Devices	14
5.9 Nameplates	14
5.10 Terminals	14

	<i>Page</i>
5.11 Position Indicating Device	14
5.101 Special Requirements for Earthing Switches	14
5.102 Leakage Currents Across Open Disconnectors	14
5.103 Mechanical Strength	14
5.104 Position of Movable Contact System and Signalling	14
5.105 Mechanical and Electrical Interlocks	14
6. TYPE TESTS	
6.0 General	16
6.1 Dielectric Tests	16
6.2 Radio-interference Voltage (RIV) Test	18
6.3 Temperature-rise Tests	18
6.4 Measurement of Resistance of the Main Circuit	18
6.5 Short-time Withstand Current and Peak Withstand Current Tests	18
6.101 Tests to Prove the Short-time Making Current Performance of Earthing Switches	18
6.102 Tests to Prove Satisfactory Operation and Mechanical Endurance	18
6.103 Tests to Prove Satisfactory Operation under Severe Ice Conditions	22
6.104 Tests to Prove Satisfactory Operation at Minimum and Maximum Ambient Air Temperatures	23
7. ROUTINE TESTS	
7.0 General	24
7.1 Power-frequency Voltage Withstand Dry Tests on the Main Circuit	24
7.2 Voltage Withstand Tests on Auxiliary and Control Circuits	24
7.3 Measurement of the Resistance of the Main Circuit	24
7.101 Mechanical Operating Tests	24
8. GUIDE TO THE SELECTION OF SWITCHING DEVICES	
8.1 General	24
8.2 Selection of Rated Values for Normal Service Conditions	25
9. INFORMATION TO BE GIVEN WITH ENQUIRIES, TENDERS AND ORDERS	
9.1 Information to be Given With Enquiries and Orders	25
9.2 Information to be Given With Tenders	26
10. TRANSPORT, STORAGE, ERECTION AND MAINTENANCE	27
11. QUALITY CONTROL DURING MANUFACTURE	27
APPENDICES	
AA Procedure for Arranging Pre-arcing Conditions when Testing Earthing Switches for Making Capacity at Reduced Voltage	28
BB Preferred Nomenclature for Types of Disconnectors and Earthing Switches and Usual Rated Voltage Ranges	29
CC Items Subject to Agreement Between the Purchaser and the Manufacturer	30
ANNEX	
Summary of Technical Variations Between this Standard and IEC 129	31

STANDARDS ASSOCIATION OF AUSTRALIA

Australian Standard

for

**HIGH VOLTAGE A.C. SWITCHGEAR AND CONTROLGEAR—
DISCONNECTORS (ISOLATORS) AND EARTHING SWITCHES**

1. SCOPE AND GENERAL

1.1 SCOPE. This standard applies to disconnectors (isolators) and earthing switches designed for use outdoors or indoors at service frequencies up to and including 60 Hz in systems having rated voltages exceeding 1000 V.

NOTE: The IEC term 'disconnector' is used henceforth throughout this standard and replaces the term 'isolator' as used in the previous edition of this standard.

This standard also applies to the operating devices of the disconnectors and earthing switches and to their auxiliary equipment.

NOTES:

1. The isolating properties assigned to disconnector-fuses and drop-out fuses should comply with the requirements of this standard. (See AS 1033.)
2. Earthing switches forming an integral part of a high voltage switch or disconnector must comply with this standard. (See AS 1025.)
3. Other parts of an installation, such as plug devices and movable circuit-breakers in metal-enclosed switchgear, may so be used as disconnectors, provided that they comply with this standard.

1.2 APPLICATION. This standard is to be read in conjunction with AS 2650 and AS 1852 (441).

1.3 REFERENCED DOCUMENTS. The following standards are referred to in this standard:

AS 1025 High Voltage A.C. Switchgear and Controlgear Switches and Switch-disconnectors

Part 1 — For Rated Voltages Above 1 kV and less than 52 kV

Part 2 — For Rated Voltages Above 52 kV*

AS 1033 High-voltage Expulsion and Similar Fuses†

AS 1265 Bushings for Alternating Voltages Above 1000 V

AS 1852 International Electrotechnical Vocabulary 1852(441) Switchgear and Controlgear

AS 1931 High Voltage Testing Techniques

Part 1 — General Definitions, Test Requirements, Test Procedures and Measuring Devices

AS 2650 High-voltage A.C. Switchgear and Controlgear—Common Requirements

2. SERVICE CONDITIONS

Clause 2 of AS 2650 applies.

3. DEFINITIONS

3.1 GENERAL. For the definition of general terms used in this standard, Clause 3 of AS 2650 applies with the following additions.

ADDITIONS

3.101 GENERAL TERMS.

3.101.1 Switchgear and controlgear—a general term covering switching devices and their combination with associated control, measuring, protective and regulating equipment, also assemblies of such devices and equipment with associated interconnections, accessories, enclosures and supporting structures.

3.101.2 Ambient air temperature—the temperature, determined under prescribed conditions, of the air surrounding the complete switching device (e.g. for enclosed switching devices, it is the air outside the enclosure).

3.101.3 Temperature rise (of a part of a disconnector or earthing switch)—the difference between the temperature of the part and the ambient air temperature.

3.102 SWITCHING DEVICES.

NOTE: See Appendix BB for specific types.

3.102.1 Disconnector—a mechanical switching device which provides, in the open position, an isolating distance in accordance with specified requirements.

NOTE: A disconnector is capable of opening and closing a circuit in which negligible current is made or broken, or when no significant change occurs in the voltage across the terminals of each of the poles of the disconnector. For the purposes of this definition a current not exceeding 0.5 A is deemed to be a 'negligible current' at rated voltages up to 362 kV, above 362 kV the manufacturer should be consulted. This generally implies that a disconnector is capable of making and breaking the capacitive currents of bushings, busbars, connections, very short lengths of cable, the currents of permanently connected grading impedances of circuit-breakers and the currents of voltage dividers and voltage transformers.

Such applications as the by-passing of induction voltage regulators or circuit-breakers are referred to above by 'no significant change in voltage'.

A disconnector is also capable of carrying currents under normal circuit conditions and carrying for a specified time currents under abnormal conditions such as those of short-circuit.

3.102.2 Divided support disconnector (or earthing switch)—a disconnector (or earthing switch) in which the fixed and moving contacts of each pole are not supported by a common base or frame.

NOTES:

1. A typical example is the pantograph disconnector.
2. This term applies to high-voltage disconnectors only.

3.102.3 Centre-break disconnector—a disconnector in which both contacts of each pole are movable and engage at a point substantially midway between their supports.

NOTE: This term applies to high-voltage disconnectors only.

* In course of preparation. (For rated voltages above 52 kV, see IEC 265, High-voltage Switches.)

† In course of revision.

3.102.4 Double-break disconnecter—a disconnecter that opens a conductor of a circuit at two points.

3.102.5 Earthing switch—a mechanical switching device for earthing parts of a circuit, capable of withstanding for a specified time, currents under abnormal conditions such as those of short-circuit, but not required to carry current under normal conditions of the circuit. Oil immersed earthing switches have a rated short-circuit making current, other earthing switches may have a rated short-circuit making current.

3.103 PARTS OF SWITCHING DEVICES.

3.103.1 Contact (of a mechanical switching device)—two or more conductors designed to establish circuit continuity when they touch and which, due to their relative motion during operation, open or close a circuit or (in the case of hinged or sliding contacts) maintain circuit continuity.

3.103.2 Contact piece—one of the conductors forming a contact.

NOTE: If no confusion can arise, the term 'contact' may be used instead of 'contact piece'.

3.103.3 Position indicating device—a part of a mechanical switching device which indicates whether it is open, closed, or where appropriate, earthed position.

3.103.4 Position signalling device—part of a disconnecter or earthing switch which enables a signal to be given, generally at a location remote from the disconnecter or earthing switch, indicating whether the contacts of the main circuit are in the open or closed position.

3.103.5 Terminal—a conducting part of a disconnecter or earthing switch provided for electrical connection to external circuits.

3.103.6 Contact zone (for divided support disconnecters and earthing switches)—the spatial region delimiting the various positions the fixed contact may take up for correct engagement with the moving contact.

3.104 CHARACTERISTIC QUANTITIES.

3.104.1 Prospective peak current—the peak value of the first major loop of the prospective current during the transient period following initiation.

NOTE: The definition assumes that the current is made by an ideal switching device, i.e. with instantaneous and simultaneous transition or its impedance across the terminals or each pole from infinity to zero. The peak value may differ from one pole to another; it depends on the instant or current initiation relative to the voltage wave across the terminals of each pole.

3.104.2 (Peak) Making current (of an earthing switch)—the peak value of the first major loop of the current in a pole of the earthing switch during the transient period following the initiation of current during a making operation.

NOTES:

1. The peak value may differ from one pole to another and from one operation to another as it depends on the instant or current initiation relative to the wave of the applied voltage.
2. Where, for a polyphase circuit, a single value or (peak) making current is referred to, this is, unless otherwise stated, the highest value in any phase.

3.104.3 Peak current—the peak value of the first major loop of current during the transient period following initiation.

3.104.4 Normal current (of a disconnecter)—the current which the main circuit of the disconnecter is capable of carrying continuously under specified conditions of use and behaviour.

3.104.5 Permissible duration of short-circuit current—the time during which a disconnecter or earthing switch in the closed position can carry a short-circuit current of specified value.

3.104.6 Peak withstand current—the value of peak current that a circuit or a switching device in the closed position can withstand under prescribed conditions of use and behaviour.

3.104.7 Rated value—a quantity value assigned generally by the manufacturer, for a specified operating condition of a component, device or equipment.

3.104.8 Rated insulation level—the insulation level of disconnecters and earthing switches is defined as the statement of two rated withstand voltages specified as follows:

- (a) For disconnecters and earthing switches with highest voltage for equipment equal to or greater than 300 kV: the rated switching and lightning impulse withstand voltages.
- (b) For disconnecters and earthing switches with highest voltage for equipment lower than 300 kV: the rated 1-minute power-frequency and lightning impulse withstand voltages.

3.104.9 Rated 1-minute power-frequency withstand voltage—the r.m.s. value of the sinusoidal alternating voltage at power-frequency which the insulation of the disconnecter or earthing switch withstands under specified test conditions.

3.104.10 Rated impulse withstand voltage—the peak value of the standard impulse voltage wave which the insulation of the disconnecter or earthing switch withstands, under specified test conditions.

NOTE: Depending on the shape of the wave, the term may be qualified as switching impulse withstand voltage or lightning impulse withstand voltage.

3.104.11 Clearance between open contacts (gap)—the total clearance between the contacts, or any conductive parts connected thereto, of a pole of a mechanical switching device in the open position.

NOTE: When determining the total clearance, the sum of the distances shall be taken into consideration.

3.104.12 Clearance to earth—the clearance between any conductive parts and any parts which are earthed or intended to be earthed.

3.104.13 Mechanical terminal load—the external mechanical load at each terminal equivalent to the combined mechanical forces to which the disconnecter or earthing switch may be subjected, not including wind forces acting on the equipment itself.

NOTES:

1. A disconnecter or earthing switch may be subjected to several mechanical forces different in value, direction and point of action.
2. Mechanical terminal loads do not include electromagnetic forces of short-circuit currents.

4. RATINGS

4.0 LIST OF RATINGS. The ratings as listed in Clause 4.0 of AS 2650 are applicable with the following additions:



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- (m) Rated short-circuit making current (for earthing switches only, where applicable).
- (n) Rated contact zone (for divided support disconnectors and earthing switches only).
- (o) Rated values of maximum force required for manual operation.

4.1 RATED VOLTAGE. Clause 4.1 of AS 2650 applies.

4.2 RATED INSULATION LEVEL. Clause 4.2 of AS 2650 applies with the following additions:

Disconnectors with rated voltage 300 kV and above are divided into two classes depending upon their rated switching impulse withstand voltage across open poles. With reference to Table 2 of AS 2650 the rated values given in column 5 apply to Class A disconnectors and the rated values given in column 6 apply to Class B disconnectors (see Clause 6.1.6.3 herein).

NOTE: All disconnectors should comply with Class A requirements. At the option of the purchaser, disconnectors may alternatively be required to comply with Class B.

At the option of the purchaser, a disconnector may also be required to be lightning impulse flashover coordinated (see Clause 6.1.6.2).

4.3 RATED FREQUENCY. Clause 4.3 of AS 2650 applies.

4.4 RATED NORMAL CURRENT AND TEMPERATURE-RISE. Clause 4.4 of AS 2650 applies only for disconnectors.

4.5 RATED SHORT-TIME WITHSTAND CURRENT. Clause 4.5 of AS 2650 applies with the following addition:

Where an earthing switch is combined with a disconnector as a single unit, the rated short-time withstand current of the earthing switch shall be at least equal to that assigned to the disconnector.

4.6 RATED PEAK WITHSTAND CURRENT.

Clause 4.6 of AS 2650 applies with the following addition:

Where an earthing switch is combined with a disconnector as a single unit, the peak withstand current of the earthing switch shall be at least equal to that assigned to the disconnector.

4.7 RATED DURATION OF SHORT-CIRCUIT. Clause 4.7 of AS 2650 applies.

4.8 RATED SUPPLY VOLTAGE OF CLOSING AND OPENING DEVICES AND AUXILIARY CIRCUITS. Clause 4.8 of AS 2650 applies.

4.9 RATED SUPPLY FREQUENCY OF OPERATING DEVICES AND AUXILIARY CIRCUITS. Clause 4.9 of AS 2650 applies.

4.10 RATED PRESSURE OF COMPRESSED GAS SUPPLY FOR OPERATION. Clause 4.10 of AS 2650 applies.

4.11 RATED MECHANICAL LOAD OF TERMINALS. Disconnectors and earthing switches should be able to close and open whilst subjected to their rated mechanical terminal loads, where assigned, plus wind loads acting on the equipment itself (see Clause 2.1.2(e) of AS 2650).

NOTE: Wind loads on outdoor equipment and conductors are of a variable nature and are increased by the presence of ice or hoar frost. Methods of proving that wind load will not endanger the equipment are under consideration.

Rated mechanical terminal loads need not be assigned to disconnectors and earthing switches which are not intended to be subject to substantial mechanical terminal loads.

Some typical rated mechanical terminal loads (not including wind forces on the equipment itself) are given in Table 1 and are intended to be used as a guide (see Figs 1 and 2). Significant vertical loads may need to be taken into account. Specific requirements shall be subject to agreement between the purchaser and the manufacturer.

TABLE 1
TYPICAL RATED HORIZONTAL MECHANICAL LOADS OF TERMINALS

1	2	3	4	5	6
Rated voltage kV	Rated normal current A	Two-column and three-column disconnectors (See Fig. 2)		Divided-support disconnectors (See Fig. 2)	
		Straight-load (F_{a1} and F_{a2}) N	Cross-load (F_{b1} and F_{b2}) N	Straight-load (F_{a1} and F_{a2}) N	Cross-load (F_{b1} and F_{b2}) N
72.5	800 to 1250	400	130	800	200
123 to 145	1250 800 to 1250	500 800	170 270	800 1250	200 400
245 to 300	2000 2000	1000 1600	330 530	1600 2000	500 800
362	4000	2000	660	4000	1600
525		(Under consideration)			

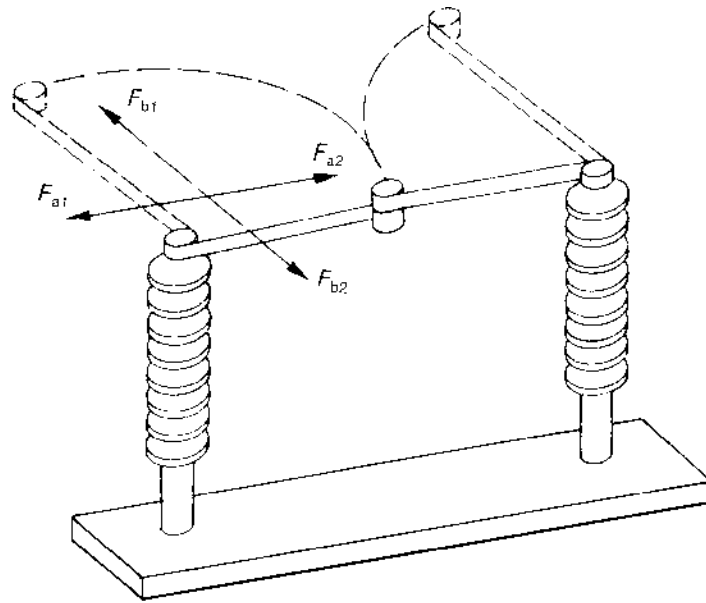


Fig. 1. TYPICAL APPLICATION OF RATED HORIZONTAL MECHANICAL LOADS TO THE TERMINALS OF A TWO-COLUMN DISCONNECTOR

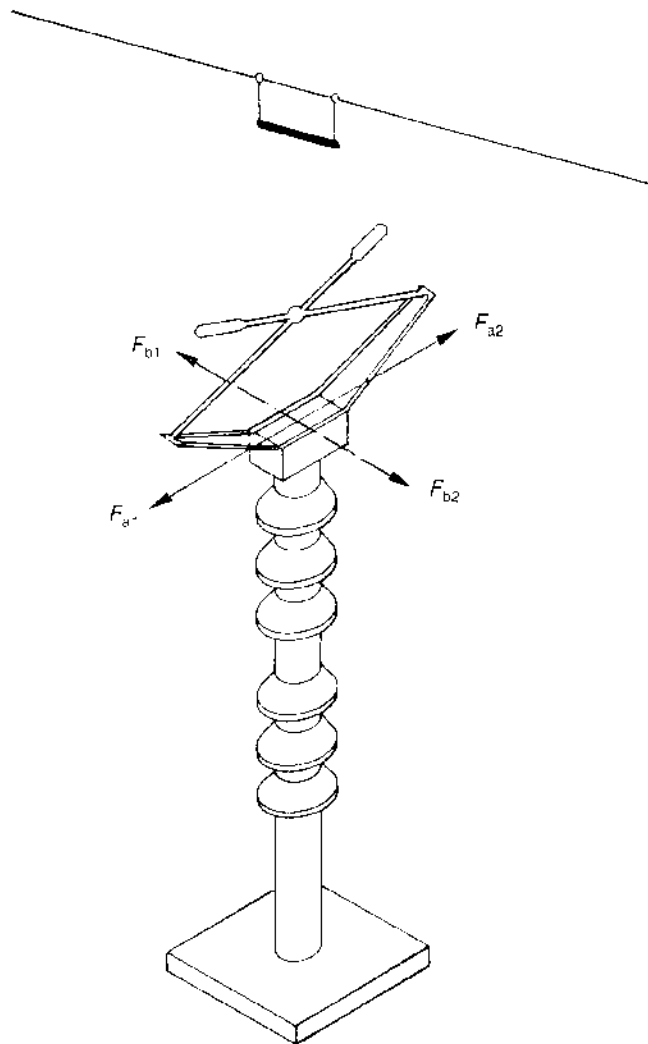


FIG. 2. TYPICAL APPLICATION OF RATED HORIZONTAL MECHANICAL TERMINAL LOADS TO A DIVIDED-SUPPORT DISCONNECTOR

4.101 RATED SHORT-CIRCUIT MAKING CURRENT. Earthing switches to which a rated short-circuit making current has been assigned shall be capable of making at any applied voltage, up to and including that corresponding to their rated voltage, any current up to and including their rated short-circuit making current.

Where an earthing switch has a rated short-circuit making current, this shall be equal to the rated peak withstand current.

4.102 RATED CONTACT ZONE. Divided support disconnectors and earthing switches shall be able to operate within the limits of their rated contact zone.

The manufacturer shall state the values of maximum and minimum mechanical reaction forces and the method of fixing the 'fixed' contact required in case these forces are relevant to the satisfactory operating conditions of the disconnector or earthing switch.

Examples of rated contact zones of disconnectors and earthing switches having 'fixed' contact pieces supported by flexible conductors are illustrated in Figs. 3 and 4 and given in columns 2 to 4 of Table 2.

Examples of rated contact zones of disconnectors and earthing switches having 'fixed' contacts supported by rigid conductors are given in columns 5 to 7 of Table 2 and in Fig. 5.

TABLE 2
EXAMPLE OF RATED CONTACT ZONES FOR 'FIXED' CONTACT PIECES

1	2	3	4	5	6	7
Rated voltage	Supported by flexible conductors			Supported by rigid conductors		
kV	L m	S m	U m	L m	S m	U m
72.5	0.30	0.20	0.20	0.10	0.10	0.10
123	0.35	0.20	0.25	0.10	0.10	0.10
145	0.35	0.20	0.25	0.10	0.10	0.10
245	0.50	0.25	0.30	0.15	0.15	0.20
300	0.50	0.25	0.35	0.15	0.15	0.20
362	0.50	0.30	0.35	0.15	0.15	0.20
525	0.60	0.40	0.50	0.20	0.20	0.25
765	0.70	0.50	0.60	0.25	0.25	0.30

LEGEND

L = horizontal deflection
 S = vertical deflection
 U = total amplitude of longitudinal movement with respect to supporting conductor.