

ISSC 14

Guide to electrical workers' safety equipment

Industry Safety Steering Committee

October 2010

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ISSC 14 Guide to electrical workers' safety equipment

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PREFACE

This Guide supersedes the September 2008 edition which replaced document EC 14 Guide to Electrical Workers' Safety Equipment 1996.

This Guide was prepared by a committee drawn from the NSW Electricity Supply Industry to assist in the development of Network Operators' Network Management Plans required under the Electricity Supply (Safety & Network Management) Regulation 2008 (The Regulation).

This revised edition makes minor amendments to the contents of First Aid Kits contained in the September 2008 edition which differed from the 1996 EC 14 guide in that it reflected changes of NSW Government philosophy away from prescriptive to outcome based guidelines.

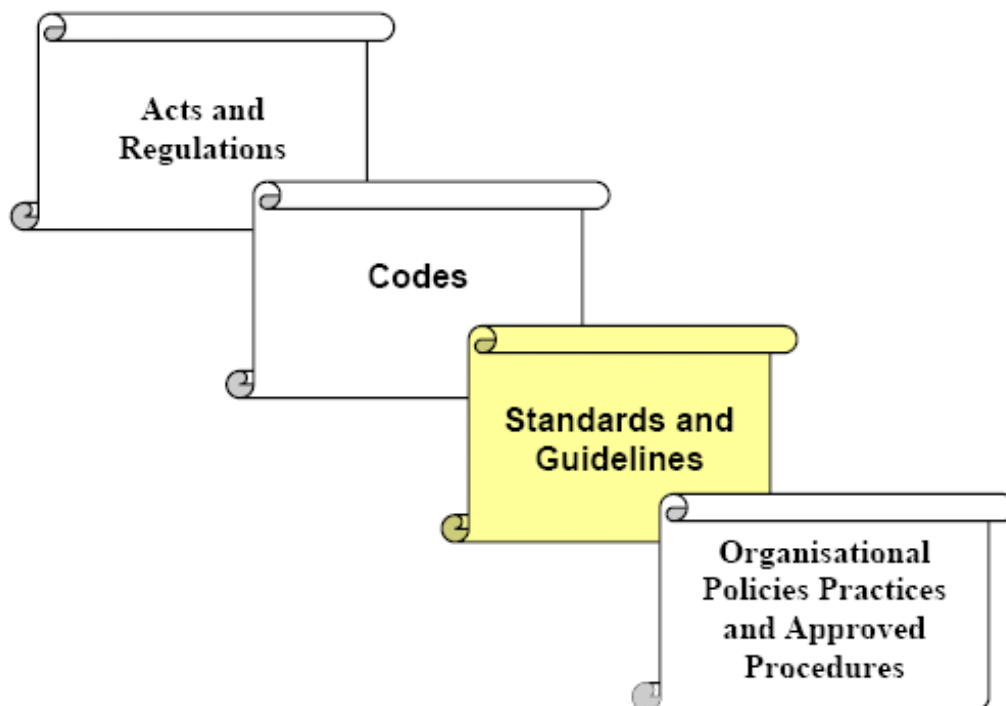
Where practicable, the Guide cites Australian Standards as the basis of a specification and, where no Australian Standards exist, it cites relevant International Standards. All Standards cited in this Guide are listed in Clause 1.1 of Chapter 1.

Where no relevant Australian or International Standard exists, current Industry practice has been provided as guidance.

The Guide's prime purpose is to ensure the safety of electrical workers. It is not intended that it be used to inhibit innovation where it enhances work practices and worker safety.

It is a guide and therefore equipment, tests, inspection or practices other than those in this document may well be perfectly satisfactory. Organisations are at liberty to provide different equipment, to specify different tests, or to inspect equipment in a manner or at intervals assessed as appropriate to particular circumstances, provided always that these alternatives are based on sound design or reasoning and that the outcome of worker safety is not prejudiced.

The following diagram outlines the framework into which this Guide fits.



Note: The use of italics indicates the word or words are as defined in this Guide.

This Guide does not substitute for, or override, any legislation or regulation enacted by jurisdictional Regulators or safety rules implemented by Network Operators. The ISSC will monitor the use and impact of this Guide and, consequently, may review and amend it from time to time.

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1 SCOPE

This document:

- Provides guidance for electricity Network Operators, Accredited Service Providers and other relevant parties to develop outcome based management procedures for the selection, use and maintenance of electrical workers' safety equipment;
- Does not include protective clothing, safety footwear, eye and face protection, head protection, insulating gloves and additional protective clothing which are covered in the National Guidelines For The Selection, Use & Maintenance Of Personal Protective Equipment For Electrical Hazards - NENS 09;
- Does not prescribe inspection, testing and maintenance frequencies, but may cite as informative, values that have been historically used in the Industry. Organisations may vary these frequencies utilising documented risk assessment processes;
- *Should* be read in conjunction with other appropriate documentation for safe working practices related to the specific type of electrical work concerned.

1.1 REFERENCED DOCUMENTS

- AS 1748: Timber - Mechanically stress-graded for structural purposes
- AS 2225: Insulating gloves for electrical purposes
- AS 3100: Approval and test specification - General requirements for electrical equipment
- AS 3527.2: Hand-operated screwdrivers and screwdriver bits - Insulated screwdrivers
- AS 60529: Degrees of protection provided by enclosures (IP Code)
- AS 61010 series: Safety requirements for electrical equipment for measurement, control and laboratory use
- AS/NZS 1873 series: Powder-actuated (PA) hand-held fastening tools
- AS/NZS 1891 series: Industrial fall-arrest systems and devices
- AS/NZS 1892 series: Portable ladders
- AS/NZS 2550.10: Cranes, hoists and winches - Safe use - Mobile elevating work platforms
- AS/NZS 2865: Safe working in confined space
- AS/NZS 2978: Insulating mats for electrical purposes
- AS/NZS 4142 series: Fibre ropes
- AS/NZS 4202: Insulating covers for electrical purposes
- AS/NZS 4417 series: Marking of electrical products to indicate compliance with regulations
- AS/NZS 4488 series: Industrial rope access systems
- AS/NZS 60079 series: Electrical apparatus for explosive gas atmospheres
- ASTM D1048: Standard Specification for Rubber Insulating Blankets

- ASTM F1236: Standard Guide for Visual Inspection of Electrical Protective Rubber Products
- ASTM F1564: Standard Specification for Structure-Mounted Insulating Work Platforms for Electrical Workers
- ASTM F1796: Standard Specification for High Voltage Detectors - Part 1 Capacitive Type to be Used for Voltages Exceeding 600 Volts a.c.
- ASTM F2249: In Service Test Methods for Temporary Grounding Jumper Assemblies Used on De-Energised Electric Power Lines and Equipment
- ASTM F479: Standard Specification for In-Service Care of Insulating Blankets
- ASTM F711: Standard Specification for Fibreglass - Reinforced Plastic (FRP) Rod and Tube Used in Live Line Tools
- ASTM F712: Standard Test Methods for Electrically Insulating Plastic Guard Equipment for Protection of Workers
- ASTM F855: Standard Specifications for Temporary Protective Grounds to be used on De-Energised Electric Power Lines and Equipment
- ASTM F968: Standard Specification for Electrically Insulating Plastic Guard Equipment for Protection of Workers
- ENA LLM series: Energy Network Association Live Line Manuals
- IEC 60855: Insulating foam-filled tubes and solid rods for live working
- IEC 60900: Live working - Hand tools for use up to 1000 V a.c. and 1500 V d.c.
- IEC 61112: Blankets of insulating material for electrical purposes
- IEC 61230: Live working - Portable equipment for earthing or earthing and short-circuiting
- IEC 61243-1: Live working - Voltage detectors - Part 1: Capacitive type to be used for voltages exceeding 1kV a.c.
- IEC 61243-2: Live working - Voltage detectors - Part 2: Resistive type to be used for voltages of 1kV to 36kV a.c.
- IEC 61243-3: Live working - Voltage detectors - Part 3: Two-pole low-voltage type
- IEC 62193: Live Working - Telescopic sticks and telescopic measuring sticks
- IEEE Std 516: Guide for Maintenance Methods on Energised Powerlines
- ISSC 28: Guideline for Enclosed Spaces in NSW Electricity Networks
- NSW Occupational Health and Safety Regulation
- Queensland Government, Department of Employment and Industrial Relations – Code of Practice for Electrical Work, 2.2 Working with ladders, scaffolds, portable pole platforms
- WorkCover NSW - First Aid in the Workplace - Guide
- WorkCover Safety Guide 4503 Portable Ladders

1.2 DEFINITIONS

This section details a list of words and terms and their definitions as intended for use in this guide. When a word or term is shown in *italics* in the text of the guide it has the following defined meaning:

Anchorage point - A secure point of attachment on a structure to which a fall-arrest device, or *lanyard* assembly or *restraint line* may be secured.

AS - Australian Standard

AS/NZS - Australian Standard/New Zealand Standard

ASTM - American Society for Testing and Materials

Attachment hardware - Any ring, hook, karabiner, tube-nut connector or other connecting device located in such a position that it *must* sustain by itself the full loading of a fall-arrest.

Boom type mobile elevating work platform (Boom type MEWP) - A MEWP in which the platform is supported by a hinged member that may be luffed, telescoped or slewed.

Contact type voltage detector - Device that is used to indicate the presence of a voltage on a surface by making direct electrical contact between the surface and the conductive probe of the detector.

De-energised - Mains and apparatus not connected to an electrical supply source, however they are not necessarily *isolated*.

Electrical apparatus - Any electrical equipment, including overhead lines and underground cables, the conductors of which are live or can be made live.

Electricity Supply Industry - The employers, employees, contractors and any other persons involved in the design, construction, maintenance or operation of the electricity generation, transmission, and distribution systems in Australia.

ENA - Energy Networks Association.

Full-body harness - An assembly of interconnected shoulder and leg straps, with or without a body belt, designed for attachment to a lanyard, pole strap or fall-arrest device for fall-arrest or work positioning purposes.

NOTE: This equipment is referred to in AS/NZS 1891.4 and AS/NZS 4488.1 as a fall-arrest harness.

Harness - A *full body harness* or a *lower body harness*.

High voltage - A nominal voltage exceeding 1000 V a.c. or exceeding 1500 V d.c. (Note: Nominal 1500V d.c. traction systems have specific industry requirements for operating and testing equipment. As such the requirements applicable to *high voltage* or *low voltage* may not be directly applicable.)

High voltage operational stick - Equipment commonly used on or near *high voltage electrical apparatus* as:

- Operating sticks, or
- Height measuring sticks.

IEC – International Electrotechnical Commission

IEEE – Institute of Electrical and Electronics Engineers

Insulating cover - a pipe or tube drape, blanket, cover or wrapping of insulating, non-hygroscopic material applied on or around conducting mains, apparatus, surfaces, and pipes so as to prevent inadvertent contact and provide an electrically safe barrier for personnel or equipment working in the vicinity.

Insulating mat - A mat of insulating and non-hygroscopic material intended to effectively provide an electrically safe barrier on which the user can stand, kneel or be otherwise supported.

Isolated - Mains and apparatus that are disconnected from all possible sources of electrical energy by: opening switches, withdrawing circuit breakers, removing fuses, links or connections, tying back bonds, and precautions such as locking and danger tagging have been taken to prevent the unauthorised or unintentional closure of the above items.

Lanyard - An assembly of a line and components which will enable a connection between a harness and an anchorage and which will absorb energy in the event of a fall.

Low voltage - A nominal voltage exceeding 50V alternating current (a.c.) or 120V ripple free direct current (d.c.) but not exceeding 1000V a.c. or 1500V d.c. (Note: Nominal 1500V d.c. traction systems have specific industry requirements for operating and testing equipment. As such the requirements applicable to *high voltage* or *low voltage* may not be directly applicable.)

Lower body harness – An assembly of a body belt and leg loops.

Mobile elevating work platform (MEWP) - A mobile machine (device) that is intended to move persons, tools and material to working positions and consists of at least a work platform with controls, an extending structure and a chassis, but does not include mast climbing work platforms.

Must - Indicates that a statement is mandatory

Pole straps - A work positioning strap designed to be placed around a pole or other vertical structural member and attached at two points, one on each side of a harness whilst the wearer is working on the pole.

Proximity type voltage detector - Device that is used to indicate the presence of a voltage without making direct electrical contact.

Shall - Indicates that a statement is mandatory.

Should - Indicates a recommendation.

2 GENERAL PRINCIPLES APPLICABLE TO ALL SUBSEQUENT CHAPTERS

The following general principles defined in this chapter are applicable to all subsequent chapters in this document. Additional principles specific to a particular chapter are included in the respective chapter.

Risks to the health and safety of employees *shall* be eliminated or controlled by ensuring the equipment selected is:

- (a) Suitable for the purpose,
- (b) Ergonomically designed to minimise manual handling issues,
- (c) Used correctly, and
- (d) Appropriately maintained and inspected.

2.1 SELECTION, INSPECTION, TESTING AND MAINTENANCE OF SAFETY EQUIPMENT

Procedures *shall* be established to ensure selection, inspection, testing and maintenance is conducted and recorded taking into account relevant legislation, Australian/New Zealand Standards (or International Standards), manufacturers' recommendations and organisational requirements.

It is advisable to have suppliers provide serial numbers or batch identifiers on safety equipment for traceability purposes.

Workers *shall* be trained to undertake the work at hand in a competent manner, understand the critical nature of safety equipment and how to identify any evident and hidden failure modes.

The inspection requirements in this document do not relieve workers and their supervisors of their responsibility for care, maintenance and inspection of their equipment, and to ensure that defects are promptly rectified.

2.2 INSPECTIONS AND TESTS

Items are required to be inspected / tested to establish a safe design, to maintain quality, or to ensure that an in-service item remains serviceable. Inspections/tests are classified as follows:

Type test - is a test to establish or confirm the required properties of a specified design. The item undergoing the type test could be damaged or stressed beyond its normal usage and therefore would not be suitable for use.

Acceptance test – is a test to which an item is subjected to ensure they meet organisational specifications.

Before work inspection/test – is an inspection/test carried out to ensure the equipment is correct for its intended application (e.g. rating, class, etc), in good working order and is defect free before work commences. If applicable, the markings *must* be checked to ensure the currency of routine inspections/tests.

Routine inspection/test – is a formally documented comprehensive inspection/test carried out at regular intervals to prove that an item is in good working order and has not suffered any damage or deterioration that may cause the item to become unsafe or fail in service. Routine inspections/tests *should* be designed and programmed by organisations based on documented risk assessment processes. However, for practical reasons, organisations may adopt documented time-proven historical practices.

Where this Guide refers to tests or certification by a manufacturer, it *should* be noted that an accredited testing body or a network operator with the necessary testing facilities may test and/or certify equipment.

2.3 RECORDING OF INSPECTIONS, TESTS AND MAINTENANCE

The outcome of all routine inspections, tests and maintenance *must* be recorded in a suitable register or database. This information may include, but is not limited to:

- The item of equipment;
- The name of the person who carried out the inspection, test or maintenance;
- The date on which, or dates over which, the inspection, test or maintenance was carried out;
- The result or outcome of the inspection, test or maintenance;
- The date by which the next inspection, test or maintenance *must* be carried out.

Organisations *should* consider adopting a system of marking or labelling equipment (or using the serial number where available) to enable verification of currency of inspections and/or tests of each item. This system *should* be easily readable and accessible to employees using the equipment in their work situation.

2.4 DEFECTIVE EQUIPMENT

When any item of equipment is found to be faulty or fails an inspection or test it *must* immediately be withdrawn from use and marked or tagged as defective. The item *must* not be used or re-issued for use until it has been repaired and successfully re-inspected or re-tested. Items which cannot be repaired *should* be destroyed or disabled so that they cannot be used.

2.5 STORAGE, TRANSPORT AND MAINTENANCE

Storage, transport and maintenance of safety equipment *should* generally be in accordance with manufacturers' instructions. This may include:

- No part of the equipment is subjected to unnecessary shock, stress or exposed to excessive heat or moisture;
- Equipment is protected from contact with sharp edges, corrosive substances and other possible causes of damage;
- Equipment is stored in a dry condition, where applicable.

Maintenance and repair of any equipment *shall* only be performed by a competent person in accordance with the manufacturer's specifications. Replacement parts *shall* be original, identical, or proven equivalent.

3 FIRST AID KITS

3.1 SCOPE

This chapter applies to portable first aid kits suitable for electrical workers.

3.2 REFERENCES

There is no Australian Standard which specifically covers first aid kits.

The minimum requirements for the provision of first aid are outlined in NSW Occupational Health and Safety Regulation and WorkCover NSW – First Aid in the Workplace - Guide and detailed in Table 3.1 below.

3.3 DESCRIPTIONS / SPECIFICATIONS

Legislation requires first aid kits to be made available at all work areas taking into consideration:

- The type of work;
- The work environment; and
- The numbers of personnel.

Organisations *should* adopt a risk management approach to determine, select and supply appropriate portable first aid kit(s) which will provide basic items for first aid should an incident occur. This risk management process *must* take into account the additional and special hazards encountered in the Electricity Supply Industry. Examples include electric shock, flash burns, snake bites and insect attacks.

A list of additional items that may be included in first aid kits used in the Electricity Supply Industry is given in Table 3.2 below.

3.4 INSPECTIONS / TESTS

Organisations *must* ensure first aid kits are routinely inspected and maintained by a designated person.

Any items used, missing, contaminated, damaged or out of date *must* be replaced as soon as possible.

Appendix A provides historically used routine inspection intervals.

TABLE 3.1 CONTENTS FOR FIRST AID KITS**Minimum Requirements:**

Item	Type A	Type B	Type C	Item
1	1	1	1	Contents List kept in First Aid Kit
2	2	1	1	Adhesive Dressing Strips, sterile, packets of 50
3	1	1	-	Adhesive Dressing Tape, 2.5 cm (minimum width)
4	2 2 2	1 1 1	1 1 1	Bags, plastic, for amputated parts: Small Medium Large
5	5	2	-	Dressings, non-adherent, sterile, 7.5 cm x 7.5.cm
6	5	2	-	Eye pad sterile, large size, 8cm (minimum width)
7	3	1	1	Gauze bandages, 5 cm X 150 cm (minimum length)
8	3	1	-	Gauze bandages, 10 cm X 150 cm (minimum length)
9	10	4	2	Gloves, disposable, single
10	1	1	-	Silver Thermal Rescue Blanket, 180cm x 125cm (minimum size) Caution – Silver Rescue Blankets are electrically conductive.
11	1	1	1	Safety pins, assorted packet of 12 pins
12	1	1	-	Scissors, universal with toothed edges, suitable for cutting heavy clothing. 12.5cm (minimum length)
13	1	1	-	Splinter forceps, 11 cm blunt ended, sterile, disposable
14	12	6	-	Saline Solution Syrette, sterile, minimum 10 ml per Syrette
15	1	1	-	Antiseptic Swab, medicated, pre-packed, (pkt. of 10 sachets)
16	8	4	1	Triangular bandages, minimum 90 cm
17	10	3	1	Wound dressings, sterile, non-medicated, Large BP Standard Dressing No. 15 – 10 cm x 10 cm.
18	1	1	1	First-aid pamphlet as approved by WorkCover

The NSW Occupational Health and Safety Regulation gives the explanation for Type A, B & C. Electrical Industry Workers first aid kit contents generally are Type “B” above and in addition may contain the following items:

TABLE 3.2 ADDITIONAL ITEMS FOR ELECTRICAL WORKERS

Item	No.	Item
19	2	Water based cooling gel burn treatment - Shall consist of 2 dressings: 1x Facial Dressing with eye, nose & mouth cut-out. 1x Body Dressing approximately 60cm x 40cm
20	1	CPR / Pocket face mask
21	1	Combine dressing, sterile, minimum size 90 mm x 200 mm.
22	2	Wound dressing, sterile, non-medicated, Small, BP Standard Dressing No. 13 – 7.5 cm x 7.5 cm.
23	3	Wound dressing, sterile, non-medicated, Large BP Standard Dressing No. 15 – 10 cm x 10 cm. (Additional to Item 17)
24	3	Bandage, heavy cotton, stretch (Crepe Bandage) 75 mm width, minimum 150 cm un-stretched length
25	1	Sting relief lotion

4 RESCUE KITS

4.1 SCOPE

This chapter applies to rescue kits used for persons working at heights, in confined spaces or near *low voltage* electrical apparatus.

4.2 REFERENCES

There is no Australian Standard which specifically covers rescue kits.

Rescue kits are generally a combination of products which individually may be covered by the following Australian/New Zealand Standards and other chapters in this Guide:

- AS/NZS 1891 series: Industrial fall-arrest systems and devices;
- AS/NZS 2865: Safe working in confined space;
- AS 2225: Insulating gloves for electrical purposes;
- AS/NZS 4142 series: Fibre Ropes;
- AS/NZS 4488 series: Industrial rope access systems.

4.3 DESCRIPTIONS / SPECIFICATIONS

Due to the individual nature of organisational requirements and the design and construction of their networks, it is probable that contents of rescue kits may vary.

Rescue kits *should* be designed for specific working environments such as on poles or lattice structures, in enclosed spaces or near *electrical apparatus*.

Rescue equipment *should* not be used for any purpose other than its intended use.

The following performance characteristics and items *should* be considered for components of a rescue kit:

- Provision of a minimum 3:1 mechanical advantage when lifting a victim;
- Provision of mechanical assistance to control the rate of descent when lowering a victim;
- Where a rope is used for rescue, it *should* have a diameter adequate for the process. This *should* take into account manual handling, if relevant;
- Adequate length of rope depending on the maximum height of rescue;
- Compatible *attachment hardware*;
- A distinctively labelled container for protection and storage of rescue equipment;
- A device for cutting of webbing or rope in an emergency;
- Appropriate protection to prevent exposure of the rescuer to electrical hazards;
- Appropriate safety equipment to prevent the rescuer falling from heights;
- Adequate lighting source.

4.4 INSPECTIONS / TESTS

Before work commences, the presence and correct assembly of all components *shall* be verified and each component suitably inspected for signs of damage, deterioration and legibility of markings.

Rescue kits and their components *shall* not be altered in any way that may affect their operation as originally recommended or supplied.

All components *shall* be examined and the full length of the rope *must* be run out and checked during routine inspections.

Appendix A provides historically used routine inspection intervals.

5 POLE STRAPS, LANYARDS AND HARNESSSES

5.1 SCOPE

This chapter applies to *pole straps*, *lanyards* and *harnesses* that are used in fall-arrest, restraint, work positioning or confined spaces. (Controlled descent systems are covered in Chapter 6.)

5.2 REFERENCES

- AS/NZS 1891 series: Industrial Fall Arrest Systems and Devices

5.3 DESCRIPTIONS / SPECIFICATIONS

It is important to ensure the compatibility of equipment in accordance with the manufacturer's instructions. Equipment used *shall* not be altered in any way that may affect the operation of any part of a system as originally recommended or supplied.

5.4 INSPECTIONS / TESTS

Before work commences, all items *shall* be visibly inspected for signs of damage, deterioration and legibility of markings.

AS/NZS 1891.4 specifies the inspections/tests requirements for *pole straps*, *lanyards* and *harnesses*.

Appendix A provides historically used routine inspection intervals.

6 CONTROLLED DESCENT SYSTEMS

6.1 SCOPE

This chapter applies to controlled descent systems that enable a worker to escape from a height at a controlled rate of descent.

6.2 REFERENCES

There is no Australian Standard which specifically covers controlled descent systems.

Related information may be found in the following standards:

- AS/NZS 1891 series: Industrial Fall Arrest Systems & Devices;
- AS/NZS 4142 series: Fibre Ropes;
- AS/NZS 4488 series: Industrial rope access systems;
- AS/NZS 2550.10: Cranes, hoists and winches - Safe use - Mobile elevating work platforms.

6.3 DESCRIPTIONS / SPECIFICATIONS

A typical controlled descent system may comprise a controlled-descent device, *attachment hardware* and a rope.

The top end of the rope is permanently attached to an *anchorage point* assessed as suitable for purpose and fed through the controlled-descent device. The device *should* already be fitted to the rope so that it is ready for immediate use in an emergency.

Controlled-descent systems *shall* be designed so that they:

- Require minimum maintenance other than occasional cleaning;
- Provide the ability for a person to descend without user interaction;
- Allow a person to descend at an acceptable rate.

When a controlled descent system is used, the issue of suspension trauma *should* be considered.

The following specifies the requirements for the components of controlled descent systems:

- (a) All *attachment hardware* *should* be self-closing and *should* only be capable of being opened by at least two consecutive actions;
- (b) *Attachment hardware* *must* be compatible with the D-rings of the safety *harness* intended to be used, so that hooks and D-rings cannot be accidentally separated;
- (c) If relying on rope friction, the friction device *should* be able to accept and slip along the entire length of rope. Care *should* be taken to verify this condition especially when a brand new system is used;

- (d) All components *shall* have a safe-working load in accordance with an appropriate AS/NZS or International Standard;
- (e) The controlled descent system *shall* be successfully type tested as per Clause 6.5 below;
- (f) The *anchorage point* itself *must* be structurally sound and located at an appropriate place;
- (g) Rope *shall* be as follows:

TABLE 6.1 SPECIFICATION OF ROPE IN CONTROLLED DESCENT SYSTEMS

1.	Material:	Synthetic-fibre.
2.	Diameter:	At least 11 millimetres (nominal)
3.	Length:	At least the distance between the <i>anchorage point</i> and the ground/landing platform plus 4 metres.
4.	Designed to be compatible with the controlled descent device.	

Controlled descent devices *shall* be marked as follows:

- Manufacturer's name or trademark;
- Safe-working load (SWL), in kilograms.

6.3.1 CONTROLLED DESCENT SYSTEMS USED IN BOOM TYPE MOBILE ELEVATING WORK PLATFORMS

Boom type MEWPs shall have a controlled descent system for each person working in it for emergency escape from the basket in addition to any means provided through the hydraulic systems of *MEWPs*.

Every person working in a boom type *MEWP* *shall* be trained and competent in the use of the control descent system.

Note 1: If the rope passes over the top of the basket, it *must* have an insulated wire rope leader at this point, to withstand a fire in the basket.

6.4 INSPECTIONS / TESTS

Before work commences, the presence and correct assembly of all components *shall* be verified and each component suitably inspected for signs of damage, deterioration and legibility of markings.

All components *must* be examined and the full length of the rope *must* be run out and checked during routine inspections.

Appendix A provides historically used routine inspection intervals.

6.5 TYPE TEST

6.5.1 SCOPE

This section sets out type tests for determining the mechanical integrity and correct operation of a typical controlled descent system relying on rope friction.

For other types of controlled descent systems, equivalent type tests *must* be designed based on their designed operational features and applicable Standards.

6.5.2 DETERMINATION OF MECHANICAL INTEGRITY

6.5.2.1 PROCEDURE

This is a static test using 3 times the safe working load. The procedure is as follows:

- (a) Assemble the system as for use and attach the rope to a point that simulates the anchor point on the elevated work platform.
- (b) Slip the device down the rope for 2 metres and then employing the designed operational action, secure the rope so that it cannot slip further through the device.
- (c) From the point on the device designed for the load, suspend a weight which is 3 times the safe working load of the device for 1 minute.

There shall be no failure or deformation or any other form of damage to any component of the system.

6.5.3 DETERMINATION OF CORRECT OPERATION

6.5.3.1 PROCEDURE

- (a) Assemble the system as for use and attach the rope to a point that simulates the anchor point on the elevated work platform.
- (b) Attach a load equal to the safe working load to the controlled descent device and arrange to let it slide freely down the rope without any form of control. The load *shall* descend at the safe design speed.
- (c) By correct use of the device check that the descent of the load can be arrested. The load *shall* come to a stop within the design distance.

7 PORTABLE LADDERS

7.1 SCOPE

This chapter applies to portable ladders.

7.2 REFERENCES

- AS/NZS 1892 series: Portable Ladders
- WorkCover Safety Guide 4503 Portable Ladders

Additionally, the stiles of timber ladders *must* be mechanically stress graded in accordance with AS 1748: Timber - Mechanically stress-graded for structural purposes.

7.3 DESCRIPTIONS / SPECIFICATIONS

Only portable ladders that have stiles made of non-conductive materials such as timber or fibreglass *shall* be used for work on or near live electrical equipment. They may, however, have conductive brackets or rungs.

Specifically, portable ladders using exposed wire reinforcement in the stiles *shall* not be used where an electrical hazard exists.

Portable ladders (other than self supporting ladders and hook ladders) *shall* have means to secure the top and the bottom of the ladder.

Portable ladders *must* be clearly marked or labelled in accordance with AS1892 Series.

7.4 INSPECTIONS / TESTS

Before work commences, the presence and correct assembly of all components *shall* be verified and suitably inspected for signs of damage, deterioration and legibility of markings.

AS/NZS 1892.5 specifies the inspection requirements of portable ladders.

Appendix A provides historically used routine inspection intervals.

8 PORTABLE POLE PLATFORMS

8.1 SCOPE

This chapter applies to portable pole platforms used by electrical workers whilst working at heights.

8.2 REFERENCES

There is no Australian Standard which specifically covers portable pole platforms.

Related information may be found in the following:

- Queensland Government, Department of Employment and Industrial Relations – Code of Practice for Electrical Work, 2.2 Working with ladders, scaffolds, portable pole platforms;
- ASTM F1564: Standard Specification for Structure-Mounted Insulating Work Platforms for Electrical Workers;
- AS/NZS 4417 series: Marking of electrical products to indicate compliance with regulations.

8.3 DESCRIPTIONS / SPECIFICATIONS

Typical characteristics for platforms are shown in Table 8.1.

TABLE 8.1 TYPICAL PLATFORM CHARACTERISTICS

Number of people	Nominal safe working load (kg)	Nominal length (mm)	Nominal width (mm)
1	135 - 150	700 - 800	250 - 400
2	270 - 300	1100 - 1200	250 - 500

Portable pole platforms *must* be type tested in accordance with the procedure detailed at the end of this chapter.

Portable pole platforms *must* be clearly marked or labelled as follows:

- Manufacturer's name, trade name, trade mark or other identification;
- Nominal safe-working load, in kilograms;

Any repairs or maintenance *must* be carried out without compromising the characteristics of the original type tested design.

Platform decks *must* have a non-slip and non-conductive surface. Platforms for live *low voltage* work on conductive poles *must* also incorporate a non-conductive 'kick-board' at the inner end.

Platforms *must* be capable of being positioned approximately horizontal and remain stable under load conditions encountered during work.

8.4 INSPECTIONS / TESTS

At acceptance inspections each portable pole platform *must* be checked to confirm that it is:

- Marked as above;
- Accompanied by a manufacturer's certificate which identifies the type or model of platform and provides proof of type testing;
- Provided with manufacturer's instructions.

Before work inspections and routine inspections *shall* verify that portable pole platforms:

- Are correctly assembled;
- Are clearly marked / labelled;
- Are free of the following defects: cracks, deformation, permanent bending, excessive corrosion, deterioration of non-slip decking surface and lack of insulation in recessed screw holes;
- and where applicable,
- Have tight joints, solid welds and fastenings (particularly noting any chain, screw or tightener associated with the platform attachment);
- Have sharp and even wedge points or serrations, which bear on the pole (for platforms used exclusively on wood poles);
- Have chain locking devices that operate freely and correctly to ensure the chain or secure banding cannot slip;
- Have replaceable points that *must* be fixed in place and unable to rotate.

Appendix A provides historically used routine inspection intervals.

8.5 TYPE TEST

8.5.1 SCOPE

This section sets out the method for determining the integrity of the nominated safe working load of a portable pole platform. It is a destructive test and the final step of the procedure is to destroy the platform so that it can never be issued for use.

8.5.2 PRINCIPLE

A portable pole platform is attached to a pole in the normal manner. A force is applied that is three (3) times the nominated safe working load to the centre on the platform. If the platform deforms, cracks or shows a permanent bend it fails the test.

8.5.3 APPARATUS

The following apparatus is required:

- (a) Device to apply a force or a weight corresponding to 3 times the nominated safe working load of the platform;
- (b) Pole (or equivalent test rig) of a type for which the platform is designed, e.g. composite material, concrete, steel or wood.

8.5.4 PROCEDURE

The procedure is as follows:

- (a) Select a portable pole platform and note the marked safe working load;
- (b) Mark the centre of the working area of the platform;
- (c) Attach the platform to the pole;
- (d) For between 60 and 65 seconds apply the appropriate weight or force at the centre of the platform, via a test 'foot' with an area of between 100 cm² and 200 cm²;
- (e) After removing the weight or force, note and record any cracking or permanent bending of the platform;
- (f) Destroy the tested platform.

8.5.5 REPORT FROM MANUFACTURER

The report *should* include the following:

- (a) Date of type test;
- (b) Model number (or equivalent) of the platform type tested;
- (c) Nominated safe working load, in kilograms;
- (d) Results of test; and
- (e) Details, if any, of any deformity, cracks or permanent bending.

9 TOOL CONTAINERS FOR WORKING AT HEIGHTS

9.1 SCOPE

This chapter applies to tool containers used when working at heights:

- On overhead poles, towers or other *electrical apparatus*; or
- From baskets of *Mobile Elevating Work Platform (MEWP)* type vehicles.

Note: Tool containers include "bucket" style bags intended for hauling aloft by rope and also pouches intended to be worn by the worker.

9.2 REFERENCES

There is no Australian Standard which specifically covers tool containers for working at heights.

9.3 DESCRIPTIONS / SPECIFICATIONS

The work environment and the responsibility to maintain a safe place of work *shall* be taken into consideration in the design of tool containers. For example, consideration *should* be given to the fact that tool containers may be used by electrical workers at ground level or at heights and may require the container to be manually lifted, carried or suspended.

The design of tool containers *should* consider:

- (a) Use of flexible, water repelling, non-conductive materials (except for minor fittings such as eyelets or fasteners which may be conductive);
- (b) Capability to accommodate an array of relevant hand tools;
- (c) Provision of means to prevent tools falling out when lifted, carried or suspended;
- (d) Ease of inserting and removing tools and equipment;
- (e) Sound attachment or anchorage mechanism to prevent the container from slipping, collapsing or falling;
- (f) Manual handling risks; and
- (g) Robustness being adequate for the intended purpose.

Tool pouches *must* not include fittings that might inadvertently be confused with the "D" rings etc of the safety harness or interfere with the proper operation of height safety system attachment hardware.

9.4 INSPECTIONS / TESTS

Before work commences, tool containers *shall* be inspected for signs of damage or deterioration.

Appendix A provides historically used routine inspection intervals.

10 GAS DETECTION AND MONITORING EQUIPMENT

10.1 SCOPE

This chapter applies to gas detection and monitoring equipment ("gas detectors" for the purpose of this chapter) used to monitor worksite atmospheric conditions.

10.2 REFERENCES

There is no Australian Standard which specifically covers every type of gas detector.

Related information may be found in:

- AS/NZS 60079 series: Electrical apparatus for explosive gas atmospheres
- NSW Occupational Health and Safety Regulation;
- AS/NZS 2865: Safe working in a confined space;
- ISSC 28: Guideline for Enclosed Spaces in NSW Electricity Networks;

10.3 DESCRIPTIONS / SPECIFICATIONS

Gas detectors *must* operate continuously and *must* simultaneously monitor concentration levels of gases the instrument is designed to detect. Whenever the concentration of a monitored gas departs from the specified limit or range, the detector *shall* indicate it by a latched audible and visible alarm. Gas detectors *shall* be designed and manufactured so that they are intrinsically safe to operate in flammable atmospheres.

10.4 INSPECTIONS / TESTS

Before work commences, gas detectors *must* be verified to be free from defects and checked to ensure correct operation in accordance with the manufacturer's instructions.

Appendix A provides historically used routine inspection intervals.

11 HIGH VOLTAGE DETECTORS

11.1 SCOPE

This chapter applies to devices used for (a) proving *high voltage electrical apparatus* energised or *de-energised*, or (b) phasing of circuits.

11.2 REFERENCES

There is no Australian Standard which specifically covers *high voltage* detectors.

Related information may be found in the following standards:

- IEC 61243-1: Live working – Voltage detectors – Part1: Capacitive type to be used for voltages exceeding 1kV a.c.;
- IEC 61243-2: Live working - Voltage detectors - Part 2: Resistive type to be used for voltages of 1kV to 36kV a.c.;
- ASTM: F1796: Standard Specification for High Voltage Detectors – Part 1 Capacitive type to be used for voltages exceeding 600 Volts AC.

11.3 DESCRIPTIONS / SPECIFICATIONS

High voltage detectors may be either *direct contact type*, *proximity type* or remote sensing type.

High voltage detectors *must* have a device to prove that the detector works correctly. This device *should* simulate a *high voltage* of similar magnitude to the system voltage concerned.

High voltage detectors *must* give a clear, definite and unambiguous indication of whether a conductor is energised or *de-energised*, regardless of the position or angle of the display component. They *should* be able to do this in direct sunlight, at night, in all weather conditions, and in high ambient noise conditions from a distance of at least 3 metres from the user.

High voltage detectors *should* preferably provide indication to both sight and hearing, but the essential requirement is that the indication be unambiguous.

Proximity type high voltage detectors, when used for proving a conductor *de-energised*, *must* be brought progressively closer to the conductor until:

- (a) It gives an indication;
- (b) The design limits prevent it from being brought any closer to the conductor; or
- (c) It touches the conductor.

Note: Caution *should* be exercised when using *proximity type high voltage* detectors near live unscreened conductors (e.g. insulation-enclosed switchgear) as misleading indications could result.

Where sticks/handles are used with *high voltage* detectors, the insulating sections of the sticks/handles *must* be capable of passing the insulation test given in Clause 13.3 of Chapter 13.

High voltage detectors used on systems subject to induced voltages (such as double-circuit lines carrying high load current) *should* be able to discriminate between induced voltage and system voltage – to prove conductors *de-energised* even if some induced voltage is present.

Each *high voltage* detector *must* have the following markings as a minimum:

- Manufacturer's name;
- Model;
- The nominal system voltage or range of voltages for which it is suitable; and
- The threshold voltage below which the detector gives no indication (if applicable).

11.4 INSPECTIONS / TESTS

Prior to each use, the detector *must* be proved for correct operation. The detector *must* also be proved immediately after any 'no indication' result.

During routine inspections *high voltage* detectors *shall* be tested for correct indication and operation when applied to a *high voltage* source appropriate to the rated voltage or the range of the detector (using a *high voltage* test set or similar means, or an in-service *high voltage* conductor).

Appendix A provides historically used routine inspection intervals.

12 LOW VOLTAGE DETECTORS

12.1 SCOPE

This chapter applies to *low voltage* detectors used for indicating that *low voltage* conductors or equipment are energised or *de-energised*. Both *contact type* and *proximity type low voltage* detectors are covered by this chapter.

12.2 REFERENCES

There is no Australian Standard which specifically covers *low voltage* detectors.

Related information may be found in the following standards:

- AS 3100: Approval and test specification - General requirements for electrical equipment;
- AS 61010 series: Safety requirements for electrical equipment for measurement, control and laboratory use;
- IEC 61243-3: Live working - Voltage detectors - Part 3: Two-pole low-voltage type;
- AS 60529: Degrees of protection provided by enclosures (IP Code);
- AS/NZS 4417 series: Marking of electrical products to indicate compliance with regulations.

12.3 DESCRIPTIONS / SPECIFICATIONS

Contact type detectors *must* give a clear and unambiguous indication, under any operating condition.

Proximity type detectors can be used to detect a voltage source but other means *must* be used to distinguish voltage levels. The proximity detectors *must* be able to withstand contact with live *low voltage* components without posing a safety hazard to the user.

Note 1: *Proximity type* detectors may give false indications due to electromagnetic fields produced by nearby *high voltage* equipment or conductors carrying high current.

Note 2: Indications on *proximity type* detectors may be affected by the insulation level between the instrument and the general mass of earth (e.g. whether the operator is wearing insulating gloves or whether the operator is standing on an *insulating mat*).

Low voltage detectors which are intended for distinguishing phase to neutral voltages from phase to phase voltages *must* provide clear and definite indications.

Low voltage detectors used for overhead line work *must* also have sufficient length of test lead to allow connection to the outer conductors on a low-voltage bare overhead line.

The 'wandering' probe *should* preferably be integral with the body of the *low voltage* detector, so that the user does not have to look at two places simultaneously.

For use on overhead lines, one lead *should* preferably be fitted with a clip for connection to a conductor.

Low voltage detectors *should* comply with the requirements for double insulated equipment as specified in AS 3100.

Consideration *should* be given to voltage transient stresses with Overvoltage Category ratings (CAT I, II, III, or IV, as specified in AS 61010) appropriate to the electrical environment in which the *low voltage* detectors are being used.

Consideration *should* be given to the necessary degrees of protection provided by enclosures (IP rating) as specified in AS 60529 appropriate to the environment.

Low voltage detectors used in situations where a known voltage source is not available for proving correct operation *must* be provided with an approved proving device or incorporate a self-testing function that verifies the detection circuit. In the case of test lamps, a device which checks the electrical continuity is satisfactory.

In addition to the markings specified in the AS/NZS 4417.1 and AS/NZS 4417.2, each *low voltage* detector *shall* be clearly and permanently marked or labelled, where applicable, with the following:

- Operating voltage range;
- Category rating; and
- IP rating.

12.4 INSPECTIONS / TESTS

Prior to each use, the detector *must* be proved for correct operation. The detector *must* also be proved immediately after any 'no indication' result.

During routine inspections *low voltage* detectors *shall* be tested for correct indication and operation when applied to a *low voltage* source appropriate to the rated voltage or the range of the detector.

Appendix A provides historically used routine inspection intervals.

Where required, calibration, testing and maintenance *should* be conducted in accordance with the manufacturer's recommendations.

13 HIGH VOLTAGE OPERATIONAL STICKS

13.1 SCOPE

This chapter applies to *high voltage*

- Operating sticks;
- Sticks used for height measuring.

This chapter does not apply to live-line tools intended for *high voltage* live line work or to dedicated earthing sticks. Live-line tools intended for *high voltage* live line work are specified in the Energy Network Association Live Line Manuals (ENA LLM 1, 2 & 3).

13.2 REFERENCES

There is no Australian Standard which specifically covers operational sticks.

Related information may be found in the following standards:

- IEC 60855: Insulating foam-filled tubes and solid rods for live working;
- IEC 62193: Live Working - Telescopic sticks and telescopic measuring sticks;
- IEEE Std 516: Guide for Maintenance Methods on Energised Powerlines;
- ASTM F711: Standard Specification for Fibreglass - Reinforced Plastic (FRP) Rod and Tube Used in Live Line Tools.

13.3 DESCRIPTIONS / SPECIFICATIONS

Operational sticks may be made entirely of insulating sections or comprise an insulating section and a handle section.

Insulating sections of operational sticks, if hollow or foam-filled, *shall* be designed to prevent moisture and contaminant ingress.

Telescopic operational sticks are made of retractable tubes and at least one insulating section.

Operating sticks are used for operating work on live *electrical apparatus* and make actual contact with them. They may be fitted with a splined head or other fitting and are intended to be used under tension/compression and/or torque.

Measuring sticks are used to determine conductor to ground and conductor to conductor distances and other clearances. Dedicated measuring sticks are not intended to be used under tension/compression and/or torque.

A hand guard or warning marker *must* be placed at the point beyond which an operator's hand *shall* not be placed whilst in use. Minimum length of the insulating section of operational sticks *shall* be appropriate to the voltage rating as given in the table below.

TABLE 13.1 VOLTAGE RATING REQUIREMENTS

Nominal phase to phase Voltage kV	Voltage Rating kV	Minimum length of the insulating section of operational sticks mm
11	12	700
22	24	1000
33	36	1000
66	72.5	1000
132	145	1500
220	245	2500
330	362	3000
500	525	4000

Each operational stick *must* be marked or labelled with the following information:

- (a) Manufacturer's name or trademark
- (b) Voltage rating, in kilovolts (kV) and
- (c) A hand guard or a warning marker placed at a point appropriate for the voltage rating.

13.4 INSPECTIONS / TESTS

Before use, operational sticks *should* be wiped clean with appropriate material to ensure hydrophobicity and examined. The finish of the sticks *must* be free of cracks, surface damage or mechanical defects. Minor surface damage such as light scratches may be acceptable.

During routine tests, each insulating section *shall* be subjected to a power-frequency voltage of 45 kV per 300 millimetres for a period of one minute. During the test the leakage current *shall* be constant and not exceed 100 microamps.

Appendix A provides historically used routine inspection intervals.

14 LOW VOLTAGE INSULATED HAND TOOLS

14.1 SCOPE

This chapter applies to hand tools specifically designed for live *low voltage* work. Only tools that comply with this chapter may be regarded as being suitable for use without additional insulation such as gloves.

14.2 REFERENCES

- IEC 60900: Live working – Hand tools for use up to 1000 V a.c. and 1500 V d.c.;
- AS 3527.2: Hand-operated screwdrivers and screwdriver bits - Insulated screwdrivers.

14.3 DESCRIPTIONS / SPECIFICATIONS

Although tools covered under this chapter are suitable for live *low voltage* work, care *must* be taken to observe the safe approach distances.

In conditions that could undermine the insulating properties of the tool (e.g. damp or polluted conditions), an approved insulating glove *should* be worn on each hand.

14.4 INSPECTIONS / TESTS

Before use, insulated tools *shall* be checked to ensure that there is no damage to or deterioration of the insulation.

Insulating tools *shall* be routinely tested according to a testing regime that takes into account such factors as the usage, handling and storage of the tools.

Any *low voltage* insulated tool failing the above inspections/tests *shall* be removed from service as a *low voltage* insulated tool. Refer to Chapter 2 for further details.

15 LOW VOLTAGE INSULATING MATS AND COVERS

15.1 SCOPE

This chapter applies to *insulating mats* and *insulating covers* for use when working on or near *low voltage electrical apparatus*.

15.2 REFERENCES

- AS/NZS 2978: Insulating mats for electrical purposes.
- AS/NZS 4202: Insulating covers for electrical purposes.

Related information may also be found in the following standards:

- ASTM F479: Standard Specification for In-Service Care of Insulating Blankets
- ASTM F712: Standard Test Methods for Electrically Insulating Plastic Guard Equipment for Protection of Workers, and,
- ASTM F968: Standard Specification for Electrically Insulating Plastic Guard Equipment for Protection of Workers.
- ASTM D1048: Standard Specification for Rubber Insulating Blankets
- ASTM F1236: Standard Guide for Visual Inspection of Electrical Protective Rubber Products
- IEC 61112: Blankets of insulating material for electrical purposes

15.3 DESCRIPTIONS / SPECIFICATIONS

An *insulating cover* *shall* be provided with a securing means, which effectively prevents inadvertent dislodgement or displacement from the protected area. The securing means *shall* be non-conductive and *shall* not significantly reduce the mechanical strength of the cover.

Consideration *should* be given in the manufacturing process to incorporate a means of monitoring the wear and tear of items. For example, multiple layers of contrasting colours may be used to indicate the point at which the wear is considered excessive.

In addition to the requirements specified in Australian Standards, organisations may also consider the Class (as defined in AS/NZS 2978 & AS/NZS4202), voltage rating and serial number to be marked on the item.

The effective insulating area of any stitched or punched cover *shall* be deemed to be that area enclosed within a border 10 mm inside the stitch or punch line.

Before using *insulating covers*, consideration *must* be given to:

- The additional loadings such as weight and wind that can result from their use.
- The impact a cover may have on the temperature of a component.
- The thermal withstand capability of the cover at the increased temperature of the component.

15.4 INSPECTIONS / TESTS

Before work commences, insulating mats and covers *shall* be visibly inspected for signs of damage, deterioration and legibility of markings.

AS/NZS 2978 and AS/NZS 4202 specify the inspections/tests requirements for insulating mats and covers.

Appendix A provides historically used routine inspection intervals.

If an item fails an inspection/test the item *must* be discarded – not repaired. Refer to Chapter 2 for further details.

16 PORTABLE EARTHING SYSTEMS

16.1 SCOPE

This chapter applies to portable earthing and short circuiting devices used by electrical workers whilst working on *electrical apparatus*. The principles of this chapter also apply to systems such as trailing earths.

This chapter does not apply to protective bonding systems which are covered in Chapter 17.

16.2 REFERENCES

There is no Australian Standard which specifically covers portable earthing systems.

Related information may be found in the following standards:

- IEC 61230: Live working - Portable equipment for earthing or earthing and short-circuiting;
- ASTM F2249: In Service Test Methods for Temporary Grounding Jumper Assemblies Used on *De-Energised* Electric Power Lines and Equipment
- ASTM F855: Standard Specifications for Temporary Protective Grounds to be used on *De-energised* Electric Power Lines and Equipment.

16.3 DESCRIPTIONS / SPECIFICATIONS

The purpose of portable earthing systems is to:

- Short-circuit and conduct to earth any induced voltages; and
- Cause protection equipment to operate as rapidly as possible and provide maximum protection to electrical workers if the cable, line or equipment is energised unintentionally.

A portable earthing system generally consists of an assembly of the following components:

- Conductors and clamps,
- Means to apply the clamps,
- Earthing attachment points, and
- Where necessary mechanisms to ensure the clamps do not disconnect under fault conditions.

Portable earthing systems must be adequate for the fault level and protection clearing time of the line or apparatus concerned. Portable earthing system ratings are designated in kA r.m.s. for a rated time. Standardised rated times are: 3, 2, 1, 0.5, 0.25, 0.1 seconds. It must not be used where it is subject to:

- more than the rated current; or
- more than the rated thermal capacity (i.e. the Joule integral, I^2t , of the rated current and rated time).

The following characteristics should be considered in the selection of portable earthing systems:

- (a) Convenience of application;
- (b) Cables remain flexible over the range of ambient temperatures;
- (c) Cables, particularly the cable/clamp interfaces, *should* be fatigue resistant;
- (d) Clamps and attachment points *should* be resistant to damage from tightening forces;
- (e) All electrical connections *should* be protected against unintentional loosening;
- (f) Adequate to withstand the mechanical forces under rated fault conditions;
- (g) Durable and resistant to corrosion;
- (h) Cable insulation *should* be rated at not less than 0.6/1kV a.c.;
- (i) Cable insulation *should* withstand 50V a.c. under fault conditions to minimise arcing;
- (j) Insulation materials *should* not produce unacceptable levels of toxic and/or corrosive vapours under rated fault temperature rise; and
- (k) Cables *should* not be significantly longer than necessary for their designed range of applications.

Portable earthing systems *should* be clearly marked or labelled as follows:

- (a) Manufacturer's name or trademark;
- (b) Model or type reference for the device;
- (c) Year of manufacture;
- (d) Rated current and time; and
- (e) Conductor cross sectional area in mm².

The manufacturer *should* provide as a minimum the following information:

- (a) Appropriate type test reports (short-circuit type tests to use the methodology described in IEC 61230 or advise the customer of variations);
- (b) Explanations of markings;
- (c) Drawings and directions for assembly including torque values for fasteners and cable insulation details;
- (d) Instructions for use and any associated risk assessments;
- (e) Guidelines for maintenance and inspection;
- (f) Designed ambient temperature range;
- (g) Any limitations/precautions for indoor/outdoor use; and
- (h) Other relevant information (e.g. need to discard after exposure to fault current).

16.4 INSPECTIONS / TESTS

Workers need to understand the critical nature of earthing equipment and how to identify any evident and hidden failure modes.

Note: If portable earthing equipment has been subjected to the passage of a fault current, it *shall* be removed from service and disposed of properly.

Commonly identified defects of earthing equipment include the following:

- Unauthorised modifications;
- Clamp – broken, distorted or worn, corroded, loose, arcing damage or seized;
- Crimp lug – inadequately crimped lugs (e.g. Indent or V-crimp etc) or corroded;
- Conductor insulation – cracked, cut, brittle, damage due to overheating or abnormal swelling;
- Conductor strands – broken (estimated at more than 1% of strands), corroded, strand separation (bird-caged), kinked or damage due to overheating;
- Earthing connection point – broken, corroded, arcing damage or inadequate rating;
- Earthing sticks or applicators – broken or damaged; and
- Attachment point – broken, loose or corroded.

Before work commences portable earthing systems *shall* be inspected for evidence of defects.

Routine inspections *shall* additionally include either of the following:

- Lug/Cable Interface Inspection

Lug/cable interface inspection may require the removal of any opaque mechanical stress relief device which covers the lug/cable interface. Removal of this device *must* be achieved without damaging the cable. The conductor *shall* be inspected and if more than an estimated 1% of the conductor strands entering the lug are estimated to be broken or corroded, the cable *must* be re-terminated. Otherwise, the mechanical stress relief device may be replaced without re-termination of the cable.

- Electrical Test

Electrical testing of the system may be used to detect defects such as loose or corroded connections, or broken or corroded conductors.

When conducting electrical tests, organisations *should* ensure that the tests are designed and conducted to achieve their intended purpose. A typical procedure is as follows:

Apply a test current (between clamps so that all terminations are tested) appropriate to the rated current of the system under test as given in the following Table. Measure and record the voltage drop. Check for any hot spots which would indicate higher than expected resistance.

TABLE 16.1 HISTORICAL MAGNITUDE OF DC TEST CURRENT

Rated current of system kA	DC test current A
< 10	100
> 10 < 25	250
> 25 < 63	500

If the voltage drop is more than 105% of that of a new system, or if any hot spots are discovered, the item is deemed to be defective.

If any of the above defects are identified, the equipment shall be deemed defective and action taken in accordance with Chapter 2.

17 PROTECTIVE BONDING SYSTEMS

17.1 SCOPE

This chapter applies to the equipment used for providing an equipotential work area by bonding together conductive parts to maintain a common electrical potential.

This chapter does not apply to portable earthing systems which are covered in Chapter 16.

17.2 REFERENCES

There is no Australian Standard which specifically covers protective bonding systems.

17.3 DESCRIPTIONS / SPECIFICATIONS

Cable jointing and overhead line work will typically require carefully documented step by step procedures utilizing insulated covers and mats in conjunction with protective bonding systems.

Organisational procedures *should* ensure that the protective bonding conductors and portable earthing conductors are correctly configured and consideration be given to the following principles:

- Portable earthing conductors, while designed to carry the vast majority of the fault current, *must* be installed at a safe distance from the workers because dangerous mechanical forces and high temperatures may be experienced in the event of a large fault;
- Protective bonding conductors, however, are located close to workers and as a result *must* be designed, used and maintained in a manner that will not lead to unacceptable risks from potential differences, mechanical forces, thermal energy or chemical emissions from melting cable insulation.

17.4 INSPECTIONS / TESTS

Before work commences protective bonding systems *shall* be inspected to ensure that the system is defect free and adequate for the intended purpose.

Portable earthing equipment used in conjunction with protective bonding systems *shall* be treated as per Chapter 16.

18 CABLE IDENTIFICATION EQUIPMENT

18.1 SCOPE

This chapter applies to equipment that enables positive identification of cables on which work is to be carried out.

18.2 REFERENCES

There is no Australian Standard which specifically covers cable identification equipment.

18.3 DESCRIPTIONS / SPECIFICATIONS

Prior to commencing work on a cable it *must* be clearly identified. Apart from visual or other physical methods for identifying underground cables at a work-site, cable identification equipment which employs industry accepted methods *should* be used. Such equipment *must* provide unambiguous identification of the correct cable. Typical techniques commonly used for cable identification are listed below:

- Audio frequency signal injection (generator and receiver);
- Current injection (a.c. or d.c.);
- Pulse injection (d.c. pulse or ramp);
- Interrupted earth (simulated sheath fault interrupted at pre-arranged intervals); and
- *High Voltage* pulsing producing explosion at the fault at the work site.

Cable identification equipment:

- *should* be category rated as applicable to AS61010.
- *shall* not be in conflict with network operational systems such as frequency injection equipment used for customer load control.

18.4 INSPECTIONS / TEST

Before work commences cable identification equipment *shall* be checked for correct operation as per manufacturer's instructions and for signs of damage or deterioration.

Appendix A provides historically used routine inspection intervals.

19 REMOTELY OPERATED CABLE SPIKING EQUIPMENT

19.1 SCOPE

This chapter applies to explosive powered or hydraulic equipment used for spiking.

Note: For the purpose of this guide, the term “spiking” includes remotely controlled stabbing, spiking and cutting of a cable to prove it is *de-energised*.

19.2 REFERENCES

There is no Australian Standard which specifically covers cable spiking equipment.

Related information may be found in:

- NSW Occupational Health and Safety Regulation;
- AS/NZS 1873: Powder-actuated (PA) hand-held fastening tools.

19.3 DESCRIPTIONS / SPECIFICATIONS

Remote operation of spiking equipment may include the use of a rope, electronic switching or an insulated hydraulic link. The spiking mechanism *should* penetrate the entire diameter of the cable.

Spiking equipment *shall* be type tested and the specifications *should* include:

- The physical design of cables on which the spiking equipment is to be used;
- The time/current characteristics of the system prospective fault current.

Spiking equipment *must* possess sufficient mechanical strength to remain intact, though not necessarily functioning, if an energised cable is inadvertently spiked.

If the cable to be proved *de-energised* is an individual single core cable, the spiking equipment needs to be earthed. This can be done in one of three ways using an earth lead from the spiking equipment to:

- A permanent earth, e.g. earthed frame of cable pits or *high voltage* earths;
- The exposed metal sheath of the identified cable and the armour wires or exposed metal sheaths of adjacent cables, where the adjacent cable is of equal or higher voltage;
- An earth stake installation.

Note: Refer to Chapter 16, Portable Earthing Systems, for information regarding the requirements for earthing equipment, as necessary.

Spiking equipment *must* be marked or tagged with the maximum fault rating. The clamp or head *should* be marked for the maximum cable cross sectional area that can be accepted.

The manufacturer *should* provide as a minimum the following information:

- (a) The types of cables on which the device can be used;
- (b) Appropriate type test reports;
- (c) Explanations of markings;
- (d) Drawings and directions for assembly;
- (e) Instructions for use and any associated risk assessments;
- (f) Guidelines for maintenance and inspection; and
- (g) Other relevant information (eg need to discard after exposure to a fault current).

In determining the selection and the use of spiking equipment, consideration *shall* be given to safety clearances based on:

- Voltage of the cable;
- Fault level;
- Protection clearance times; and
- Physical location of the worksite.

Additional information specific to explosive powered and hydraulic equipment is as follows:

19.3.1 EXPLOSIVE POWERED EQUIPMENT

This type of spiking device generally consists of a unit clamped to the cable, with a spike or chisel which is driven into the cable by an explosive cartridge. A rope of adequate length is used to trigger the cartridge, thus allowing the operator to be remote from the spiking area.

Explosive-powered equipment *shall* only be used by staff properly trained in their use and who hold a certificate of competency as required by the NSW Occupational Health and Safety Regulation.

Explosive powered equipment *shall* comply with the testing and marking requirements for AS/NZS 1873 series.

19.3.2 HYDRAULIC EQUIPMENT

This type of spiking device generally consists of a unit clamped to the cable, with a cutter driven by a hydraulic actuator. The hydraulic fluid used in the device *must* be fire resistant. If the hydraulic hose extends from the spiking head to the operator, it *shall* be non-conductive and of appropriate length to ensure that the operator is not subjected to hazardous conditions.

19.4 INSPECTIONS / TESTS

Before work commences cable spiking equipment *shall* be checked for correct operation as per manufacturer's instructions and for signs of damage or deterioration.

Appendix A provides historically used routine inspection intervals.

Appendix A

HISTORICAL ROUTINE INSPECTION AND TESTING FREQUENCIES

(Informative Only)

TABLE A.1 HISTORICAL ROUTINE INSPECTION AND TESTING FREQUENCIES

Equipment	Routine Inspection / Test Frequency	Chapter
First aid kits	6 monthly	3
Rescue kits	6 monthly	4
Pole Straps, Lanyards and Harnesses	6 monthly	5
Controlled descent systems	6 monthly	6
Portable ladders	6 monthly	7
Portable pole platforms	6 monthly	8
Tool containers for working at heights	6 monthly	9
Gas detection and monitoring equipment	6 monthly	10
High voltage detectors	12 monthly	11
Low voltage detectors	6 monthly	12
High voltage operational sticks	12 monthly	13
Low voltage insulated hand tools	6 monthly	14
Low voltage insulating mats and covers	6 monthly	15
Portable earthing systems	6 monthly - same as before work inspection 3 yearly - routine inspection or test	16
Protective bonding systems	Before work inspection only	17
Cable identification equipment	6 monthly	18
Remotely operated cable spiking equipment	6 monthly – same as before work inspection Earthing cables used are inspected / tested as per Portable earthing systems	19