AS/NZS 4249:1994

Australian/New Zealand Standard

Electrical safety practices—Film, video and television sites

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The following interests are represented on Committee EL/39:

Australian Broadcasting Corporation
Australian Electrical and Electronic Manufacturers Association
Australian Film Commission
Commercial Film Production Association
Federation of Australian Commercial Television Stations
Film lighting supply interests
Film Queensland
The Independent Producers and Directors Guild Inc. of New Zealand
Media Entertainment Arts Alliance
Ministry of Commerce, New Zealand
New Zealand Film and Video Technicians Guild
Office of Energy, New South Wales
Screen Production Association of Australia
Television New Zealand
Transportable generating set interests
WorkCover Authority N.S.W.

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PREFACE

This Standard was prepared by the Joint Standards Australia/Standards New Zealand Committee EL/39 on Electrical Safety—Film and Television Sites.

This Standard is issued as a Joint Standard under the terms of the Active Cooperation Agreement between Standards Australia and Standards New Zealand.

The objective of this Standard is to specify safe working practices for the supply and use of electricity for lighting and power on film, video and television sites.

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STANDARDS AUSTRALIA/STANDARDS NEW ZEALAND

Australian/New Zealand Standard

Electrical safety practices—Film, video and television sites

1 SCOPE This Standard indicates the minimum safety requirements for temporary electrical installations which supply electricity to appliances and equipment on film, video and television sites and for the in-service testing of portable and transportable equipment used on these installations.

This Standard does not apply to electrical installations on theatre stages, concert locations and permanent television studios, except for additional equipment supplied through a temporary distribution system for film and television work.

2 APPLICATION Electrical work shall be carried out in accordance with the appropriate requirements of AS 3000 for Australia and The Electricity Regulations 1993 for New Zealand, except as varied herein and with the applicable additional requirements of this Standard.

This Standard applies to temporary electrical installations, portable distribution systems, appliances and equipment connected to temporary electrical supply used in connection with the following:

(a) Dry hire studios.

(b) Buildings and their environs used as temporary studios.

(c) Interior and exterior locations.

3 REFERENCED DOCUMENTS The following documents are referred to in this Standard:

AS	
1418	Cranes (including hoists and winches) (known as the SAA Crane Code)
2211	Laser safety
2790	Electricity generating sets—Transportable (Up to 25 kW)
3000	Electrical installations—Building, structures and premises (known as the SAA Wiring Rules)
3010	Electrical installations—Supply by generating set
3010.1	Part 1: Internal combustion engine driven sets
3760	In-service safety inspection and testing of electrical equipment
SAA	
HB13	Electrical equipment for hazardous areas
NZS	
5821	Laser safety
AS	APPROVAL AND TEST SPECIFICATION
3100	General requirements for electrical equipment
3116	Electric cables—Elastomer insulated—For working voltages up to and including 0.6/1 kV
3147	Electric cables—Thermoplastic insulated—For working voltages up to and including 0.6/1 kV
3190	Residual current devices (current-operated earth-leakage devices)
3191	Electric flexible cords
3199	Approval and test specification for cord extension sets

Regulations

1993/75 The Electricity Regulations 1993 of New Zealand

NZ ECP4 New Zealand Electrical Code of Practice for Electrical Installations—Supply by generating systems not exceeding low voltage

4 DEFINITIONS For the purpose of this Standard, the definitions given in AS 3000 and those below apply.

4.1 Competent person—a person who has acquired through training, qualification or experience, or a combination of these, the knowledge and skills enabling that person to perform the task required.

4.2 Dry hire studio—a studio or building available for hire without film, television or video production equipment.

4.3 Gaffer—head of the lighting and electrical departments for shooting responsibilities.

4.4 HMI lamp—a medium arc, high efficiency, high intensity discharge lamp capable of maintaining a 5600 K colour temperature.

4.5 Hook-ups—any temporary connection for electricity supply from a fixed wiring installation, other than by means of plugs and sockets.

4.6 Residual current device (RCD)—a device intended to isolate supply to protected circuits, socket-outlets or equipment in the event of a current flow to earth which exceeds a predetermined value.

4.7 Site—any place, interior or exterior, permanent or temporary, where film, television or video production takes place.

4.8 Temporary electrical installation—an installation where the wiring is not intended to form part of the permanent installation.

5 GENERAL SAFETY PROCEDURES

5.1 Liquids around electrical equipment Containers of liquids (e.g. drinks) shall not be placed on any electrical appliance or fitting.

5.2 Notification of electrical hazards All electrical hazards or potential electrical hazards shall be advised immediately as they arise, to the person with delegated responsibility. All persons on the site shall be advised of the hazard as necessary and immediate steps shall be taken to correct the situation.

5.3 Disconnection of power in adverse conditions Electric shocks are a high risk in adverse climatic conditions and in some water locations. In the event that the gaffer or other competent person feels that the risk is unacceptable, he/she shall inform the person with delegated responsibility that the power shall be disconnected until the situation is rectified.

5.4 Clearance between mechanical equipment and overhead electric power lines Overhead power lines (conductors) are an often overlooked danger. Care shall be exercised to avoid the dangers of overhead conductors when operating cranes, boom swinging, carrying tall objects, being in a boat with a mast up on the water or on a trailer on land. There must be a minimum of 4 m clearance between overhead conductors and any equipment, or greater if specified in AS 1418.

5.5 Hazardous areas Guidance to the use of electrical equipment in hazardous areas may be obtained from SAA HB13.

6 RESIDUAL CURRENT DEVICES

6.1 Compliance RCDs shall comply with AS 3190. For New Zealand they shall be of a type not affected by pulsating direct current.

6.2 Protection RCDs with a rated residual current not exceeding 30 mA shall be installed to protect:

(a) All socket outlets.

(b) All final sub-circuits.

(c) All individual circuits.

For the purpose of this Standard, the outlet socket on an in-line portable RCD may be taken to be the socket outlet.

NOTE: Care should be taken to avoid unwanted tripping due to accumulated leakage currents.

6.3 Testing Ensure that every RCD is—

(a) functionally trip tested using the RCD test button by a competent person daily before use, or prior to the commencement of each operational period;

(b) subjected to an operational performance test with an RCD tester which connects the active to the socket earth pin during the test, in accordance with the requirements for portable RCDs in AS 3760, conducted by a competent person every three months.

NOTE: The operational test may be conducted more often, dependent upon frequency and severity of use.

6.4 Recording Record operational tests in a permanent and readily accessible format held on site or at the owner's premises. The record shall include the following—

(a) the plant number of the RCD;

(b) the result of the test;

(c) the date of the test;

(d) the name (printed) of the person performing the test; and

(e) the serial number of the RCD operation test instrument.

7 CABLES, CORDS AND CORD EXTENSION SETS

7.1 Cables

7.1.1 *Types of cables* Fixed wiring cables shall be of a stranded insulated and sheathed type. Flexible cables shall comply with AS 3116 or AS 3147.

7.1.2 *Installation*

7.1.2.1 *Protection of cables* Cables shall be—

(a) located in positions where they are not subject to mechanical damage or damage by liquids; or

(b) provided with suitable protection against mechanical damage or damage by liquids. Cable ramps or rubber mats shall be used where cables are crossing walkway areas. If ramps or mats are not available, cables shall be supported overhead.

NOTE: Cables may require de-rating when enclosed or covered by mats.

7.1.2.2 *Underground* Cables may be buried either directly in the ground or in appropriate underground enclosures. The minimum depth of laying shall be—

(a) for areas subject to vehicular traffic . . . . . 150 mm; and

(b) for other areas . . . . . 75 mm.

Further mechanical protection shall be provided where the cables are likely to be subject to mechanical damage.

7.1.2.3 *Overhead* Cables may be supported overhead provided that—

(a) the span does not exceed 45 m;

(b) a span exceeding 13 m shall have the cables fixed to a catenary wire; and

(c) the minimum clearance from the ground is—

(i) over areas subject to vehicular traffic . . . . . 4.5 m; or

(ii) over other areas . . . . . 2.5 m.

7.2 Cords Clauses 7.2 to 7.4 do not apply to flexible cords with a length no more than 5 m and permanently attached to appliances or luminaires.

7.2.1 *Type of cords* Fixed wiring and flexible cords shall be heavy-duty sheathed and shall comply with AS 3191. The sheath shall not contain the colour green.

7.2.2 *Minimum conductor size* The minimum cross-sectional area of conductor shall be 1.0 mm^2.

7.2.3 *Maximum length* The maximum length of a flexible cord shall be such that the maximum load current supplied shall not produce a voltage drop in the cord exceeding 10% of the input voltage. See Table 1 for the maximum lengths of flexible cord when passing the cord rated current.

7.2.4 *Earthing Conductor* An earthing conductor shall be enclosed in the same sheath as associated live conductors.

7.2.5 *Protection of flexible cords* Flexible cords shall be—

(a) located in positions where they are not subject to mechanical damage or damage by liquids; or

(b) provided with suitable protection against mechanical damage or damage by liquids. Cable ramps or rubber mats shall be used where cords are crossing walkway areas. If ramps or mats are not available, cords shall be supported overhead.

NOTE: Cords may require de-rating when enclosed or covered by mats.

7.3 Cord extension sets Cord extension sets shall comply with AS 3199.

7.4 Limitations on the use of flexible extension cords and cables Flexible cords and cables shall not be used while in a coiled or reeled configuration.

8 PLUGS, PLUG SOCKET ADAPTORS AND PORTABLE OUTLET DEVICES

8.1 Plugs

8.1.1 *Paralleling* The individual pins of three-phase plugs shall not be connected in parallel to supply single-phase loads.

8.2 Plug socket adaptors Double adaptors and 3-pin plug adaptors (piggy-back) and similar fittings are not permitted in Australia.

8.3 Portable outlet devices Portable outlet devices shall comply with AS 3100 and the following:

(a) The enclosure shall be constructed of a suitable impact-resistant and durable material.

(b) Equipment mounted on the device shall be flush mounted or be protected against damage by suitable means.

9 PORTABLE DISTRIBUTION BOARDS

9.1 Construction Portable distribution boards shall be of robust non-corrosive design, and the socket outlets and associated control gear shall be protected against mechanical damage. When used outdoors, they shall be protected against the weather with a minimum IP23 degree of protection, which shall effectively protect the socket outlets when plugs are inserted.

TABLE 1

MAXIMUM LENGTHS OF FLEXIBLE CORD WHEN PASSING THE CORD RATED CURRENT

Cord extension set rating A	Conductor area mm^2	Maximum length of flexible cord m
10	1.0	25
	1.5	32
15	1.5	25
	2.5	40
20	2.5	32
	4.0	40

9.2 Cable entry Bush all holes provided for cable access to prevent damage to the cabling.

Covers shall be provided with a suitably bushed slot to prevent damage to the flexible cables and cords.

9.3 Main isolating switch Every board shall be provided with a clearly labelled main isolating switch.

10 LIGHTING FIXTURES AND PORTABLE ELECTRICAL EQUIPMENT

10.1 Disconnection from the power Any equipment shall be electrically isolated from the power source before proceeding to work on it, e.g. changing light bulbs/lamps.

10.2 Support and restraint The following features shall be provided—

(a) All lighting fixtures or equipment shall be adequately supported or mounted to prevent tipping or falling.

(b) Rain and wind can cause units to fall. Equipment shall be secured against this event.

(c) Suspended equipment shall have a separate safety chain or cable to prevent falling. The chain or cable shall have welded links or be made of wire rope. Removable accessories (e.g. barn doors) shall be similarly restrained by their design or by added restraints. Static load rating of safety chain or cable shall be 10:1.

(d) Any open-faced lighting unit shall have protection where practicable (wire mesh, safety glass) against the shrapnel effect caused by an exploding bulb/lamp, particularly when in close proximity to people.

(e) Every lampholder of the edison screw type shall be connected to the supply so that where a neutral conductor is required it shall be connected to the outer contact.

10.3 Protection of electrical equipment from water All electrical equipment not appropriately IP rated shall be covered in adverse conditions to prevent water from entering the equipment.

10.4 Total immersion in water of lights and fixtures Underwater lights and equipment rated above 32 V a.c. and fixtures shall have a degree of protection IPX8 and be protected by an RCD having a rated residual current not exceeding 30 mA.

10.5 Protection from ultraviolet radiation from HMI lamps The following precautions shall be taken:

(a) All personnel on site should be advised that various ‘arc’-type lamps, including HMIs, emit much larger amounts of ultraviolet (UV) radiation than tungsten lamps. Care shall be taken to protect against skin and eye damage when they are set up close to people.

NOTE: There are various filters available to reduce UV light.

(b) All HMIs should be used with UV filters. Fixtures shall not be used if the filters are cracked or broken. Micro switches shall not be bypassed.

(c) A UV filter/gel shall be used in conjunction with a clear glass filter when using open-face HMI lamps; otherwise these can cause injuries including eye damage and headaches for crew and cast members. A filter or safety glass lens also protects against exploding bulbs.

10.6 Combustible materials near lamps The use of any combustible material in close proximity to lamps shall be avoided to prevent fire or the emission of dangerous fumes.

11 LASERS

11.1 Qualified operator Only a person competent in the use of lasers shall operate laser equipment.

11.2 Notification and briefing When lasers are to be used, all personnel shall be adequately informed and briefed before shooting commences.

11.3 The laser equipment and operator shall comply with AS 2211 for Australia and NZS 5821 for New Zealand.

11.4 General care The following care shall be taken:

(a) Look away from laser lenses or beams.

(b) Avoid laser beams from reflective surfaces.

12 HOOK-UPS (TEMPORARY CONNECTIONS)

12.1 Qualifications No temporary connections shall be made unless by a person holding relevant qualification, and in accordance with any local supply regulations.

12.2 Sufficient time available Sufficient time shall be allowed to make a temporary connection.

12.3 Signs Signs shall be posted near temporary connections warning personnel of their existence.

12.4 Identification Temporary wiring within permanent structures or where permanent wiring exists shall be clearly identified at the point of origin.

13 GENERATING SETS

13.1 General Transporting generating sets up to 25 kW shall comply with AS 2790 excluding the requirement to connect the centre-tap of a two-phase winding to the frame (ECP4 for New Zealand), except as varied in this Standard. Generating sets shall be installed and operated in accordance with AS 3010.1 excluding the requirement to connect the centre-tap of a single-phase winding to the generating set bonding system (ECP4 for New Zealand), except as varied in this Standard.

13.2 Electrical connections All electrical connections to a generating set shall be made by a competent person.

13.3 Protection All generators used on a film site shall have an earthing system suitable to operate an RCD when tested to Clause 6.3(b). The main breaker shall be fitted with an RCD. This would include, for example, a 500 W generator running a video split or an industrial generating set on a remote location. If the RCD fitted is rated above 30 mA, a portable in-line unit rated 30 mA max. shall be used.

13.4 Alternative supply On all exterior night shoots, where a stunt or other hazardous situation may develop, due to a blackout (either by RCD trip, circuit breaker trip or mechanical failure), an alternative source of supply shall be available to operate sufficient lighting for safety.

13.5 Testing Generators shall be tested every 6 months. This test shall include (but not be limited to) the testing of the RCD, MEN link integrity and insulation.

14 EARTHING AND EQUIPOTENTIAL BONDING

14.1 For Australia, the following bonding requirements shall apply in situations where potential exists for personnel to make contact with equipment supplied from two separate sources:

(a) If a generator is used in combination with a solidly earth mains power supply, then the generator shall be of a type with approved earth connections made between both systems, to eliminate difference in earth potential. This would also apply if two or more generators were being used alongside each other.

(b) Any metal structures with an electrical appliance or lamp shall be bonded by an earth strap or earth stake.

(c) Bonding strap shall be of a minimum 6 mm^2.

NOTE: Clause 14.1 is subject to further consideration.

14.2 For New Zealand, the Electricity Regulations 1993 and NZECP4 apply.

15 EQUIPMENT TESTING AND RECORDING For New Zealand, the requirements of AS 3760 apply. For Australia, the following requirements apply.

15.1 Electrical equipment

15.1.1 Ensure that all flexible extension cords, portable lights, electrical equipment and electrical appliances supplied at a voltage above 32 V a.c. (extra low voltage) used as production equipment on site are inspected, tested and tagged by a competent person at six-monthly intervals. Double-insulated equipment need only be inspected.

NOTE: The inspection, testing and tagging should be conducted more often, depending upon frequency and severity of use.

15.1.2 Record the details of inspections and tests in a permanent and readily accessible format kept on site or at the owner's premises.

15.1.3 Ensure that details in the records show—

(a) the date of inspection;

(b) the equipment number or inspection number of the item inspected;

(c) the results of the tests and inspections and details of any repair work; and

(d) the name (printed) of the competent person.

15.1.4 The record of inspections shall be made available to an inspector on request.

15.1.5 At the date of test attach a current colour coded tag as specified in Clause 15.1.8.

15.1.6 Ensure that the tags specified show—

(a) the date of the inspection;

(b) the equipment number or inspection number of the item inspected; and

(c) the name of the person carrying out inspections and tests.

15.1.7 The tag will be valid for the months that the colour tag represents.

15.1.8 Use a colour tag for each six months ±2 weeks as follows—

RED January to June; and

BLUE July to December.

15.1.9 Ensure that all tags are—

(a) durable;

(b) non-metallic;

(c) self-adhesive or otherwise positively secured;

(d) incapable of re-use; and

(e) bright and distinctive in appearance.

NOTE: It is recommended that the tags be placed at the plug (male) ends of the electrical equipment.

15.2 Hired equipment and appliances

15.2.1 Ensure that all electrical equipment or appliances hired for a site are inspected, tested, tagged and recorded at the supplier's premises prior to issue. Tags shall comply with Clause 15.1.8.

15.2.2 It is the responsibility of the person who has hired the electrical equipment or appliances to meet the conditions of testing, tagging and recording as required during the period of hire.

15.3 Equipment inspections and tests

15.3.1 *Inspection* When inspecting electrical equipment, ensure that—

(a) the outer sheath of electrical cords is not damaged to an extent that reveals the insulation of the inner conductor;

(b) the sheath of all electrical cords is secured at the ends; and

(c) rewirable plugs and extension sockets are correctly connected and serviceable.

15.3.2 *Testing*

NOTE: Care needs to be exercised to ensure that insulation resistance testing does not damage electronically controlled equipment.

Do not perform insulation resistance tests between active and neutral conductors. When testing electrical equipment, ensure that—

(a) all electrical equipment, extension cords and portable power tools are subjected to an insulation resistance test conducted at 500V d.c. with a minimum acceptable level of insulation resistance as per Table 2;

(b) all electrical equipment, extension cords and portable power tools, except for double-insulated tools, have a continuous and safe level of electrical conductivity for the earthing system in accordance with Table 3; and

(c) debris or other accumulated matter will not adversely affect the safety of the plant.

TABLE 2

INSULATION RESISTANCE AND CONTINUITY TESTS

Class of equipment	Where measured	Minimum insulation resistance
Class I (single insulated)	(a) Between each live conductor and the earthing conductor (b) A continuity test between the earthing conductor and any exposed metal of the equipment	1 MΩ
Class II (double insulated)	Between each live conductor and accessible conductive parts	1 MΩ
Extension cords	Between each live conductor and the earthing conductor	1 MΩ

TABLE 3

PROTECTIVE EARTHING

Parts to be measured	Maximum resistance (Ω)
Between the earthing pin of the supply plug and exposed metal	0.5
Between the earthing pin of the supply plug and oscillating or rotating metal parts (such as drill chucks)	1.5
Between the earthing pin of the supply plug and the earthing contact of any outlet sockets of cord extension sets, portable RCDs or portable outlet devices	1.0

16 FIRE EXTINGUISHERS

16.1 Locations Fire extinguishers suitable for electrical fires shall be available on all film, video and television sites, in accordance with the local regulatory authority requirements.

16.2 Generating sets Fire extinguishers suitable for electrical and oil fires shall be carried on generating sets used at film and television sites.