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NEW ZEALAND FRESHWATER FISHERIES MISCELLANEOUS REPORT NO. 98

**SPECIFICATIONS FOR DESIGN AND
CONSTRUCTION OF
ELECTRIC FISHING MACHINES**

by

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CHRISTCHURCH

Servicing freshwater fisheries and aquaculture

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NEW ZEALAND FRESHWATER FISHERIES MISCELLANEOUS REPORTS

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APPROVAL

The specifications defined in this report have been adopted by MAF Fisheries and are effective from 1 August 1991. All new equipment must comply with these specifications. For existing equipment, there is a transition period of two (2) years, during which the required modifications can be carried out. From 1 August 1993, all electric fishing equipment in use in New Zealand must comply with these specifications.

Approval of these specifications is given in accordance with the Electric Fishing Regulations 1983 Part VII, Regulation 54, with special reference to Sub-clause II of this Regulation.

A handwritten signature in black ink that reads "P.R. Todd". The signature is written in a cursive style and is underlined with a single horizontal line.

P R Todd, Dr
Manager Freshwater Research and Management

1. INTRODUCTION

Electric fishing is the most widely used technique for sampling fish in New Zealand's rivers and streams. Potentially, the combination of people, water, and electricity is lethal. That is why it is essential to ensure that the design, construction, and use of electric fishing equipment is strictly controlled.

A great deal of research and development has gone into the electric fishing machines currently in use in this country. This has made them particularly suited to New Zealand waters. In addition, safety features have been developed that are not available in overseas' equipment.

The problems involved in the construction, maintenance, and repair of electric fishing equipment differ considerably from those associated with normal mains operated equipment. Some practices that would be considered essential to safe operation for normal mains equipment would be highly dangerous for electric fishing equipment.

Specifications to control the design and construction of electric fishing equipment for use in New Zealand have now been defined. The purpose of these specifications is to minimise the risk of electric shock that could arise from breakdown or poor design. The specifications will enable users to maintain, repair, design, or construct electric fishing equipment to meet MAF Fisheries requirements, in accordance with the Electric Fishing Regulations 1983, Section VII. Note that the issuing of any certificate of approval for any piece of electric fishing equipment remains the responsibility of MAF Fisheries.

If there are any details about the application of these specifications that are unclear, please do not hesitate to contact the Electric Fishing Service, Freshwater Fisheries Centre, MAF Fisheries, PO Box 8324, Christchurch. (Telephone: (03) 348-8939. Facsimile: (03) 348-5548.) Our concern is to ensure that the highest possible standards of safety are maintained.

2. SCOPE

These specifications outline electrical safety requirements for electric fishing machines intended for operation from a supply source not exceeding 240V a.c., and including:

- (i) back-pack models supplied from an associated battery supply;
- (ii) low voltage units supplied via a plug and socket connection (either portable or semi-portable).

3. ASSOCIATED STANDARDS

3.1 Definitions

NZS 6200 = Specification for: General Requirements for Electrical Apparatus and Material.

AS 2790 = Electricity Generating Sets - Transportable (up to 25KW).

EWR's = Handbook to the Electrical Wiring Regulations 1976.

AS 1939 = Classification of Degrees of Protection Provided by Enclosures for Electrical Equipment.

FFR 1983 = The Freshwater Fisheries Regulations 1983.

4. EFFECTIVE DATES

4.1 New Equipment

These specifications are effective from 1 August 1991.

4.2 Existing Equipment (modifications)

These specifications are effective from 1 August 1993.

5. DEFINITION

Electric fishing equipment shall consist of the pulse unit and all those parts electrically connected to it, or used to support or carry those parts.

6. GENERAL REQUIREMENTS

As far as is reasonably possible, electric fishing equipment shall comply with the electrical safety requirements of the EWR's and NZS 6200, and shall meet "Double-Insulated Appliance" standards as outlined in that publication.

7. ADDITIONAL REQUIREMENTS

7.1 Control Unit

The pulse control unit, when assembled for use, shall consist of one unit with all controls and switches used for adjustment located on that unit.

The IP rating shall be not less than IP 44 of AS 1939.

7.2 Isolation Switch

There must be one isolating switch in an accessible position which, when turned off, completely disables the equipment. This switch must be red in colour, or outlined in red, and must be capable of being set in only two positions, these being clearly marked on and off.

7.3 Overload Protection

In equipment having an average continuous power output exceeding 100 watts, overload and short circuit protection must be provided to protect the primary power source, the pulse unit, and leads from damage or overheating. Where these components are designed to withstand overload and short circuit conditions, this protection need not be fitted.

Protection can be provided by a non-user adjustable thermal and magnetic circuit breaker or electronic control. Both systems must be able to withstand maximum fault currents without failure.

7.4 Control Unit Outputs

Output shall be direct current or pulsed direct current only. Pulse shape can be square wave, sinusoidal, half sinewave, or exponential. Intermixing these pulse shapes is allowable. Alternating current output is not allowed.

Peak output voltage shall not exceed 600 volts for portable pack mounted equipment or 750 volts for low voltage operated equipment under all conditions of use.

Frequency of output pulses can be between 10 and 200 pulses per second. Output pulses can be modulated.

7.5 Capacitors

Every capacitor, unless incorporated for the sole purpose of radio frequency suppression, shall be provided with means for its prompt automatic discharge immediately the supply is disconnected. This requirement shall not apply to small capacitors where no risk of shock can arise.

7.6 Safety Circuit

All electric fishing pulse control units shall be fitted with a safety circuit. This circuit shall automatically remove the high voltage from the electrodes and their inter-connecting leads whenever the anode is removed from the water.

If this circuit uses a pilot voltage applied to the anode in a resistance-measuring configuration, the pilot voltage must not exceed 12 volts.

The total external resistance at which the high voltage can be applied must be less than 8K ohms. A four-position switch, wired to allow the high voltage to turn on at 8K ohms and a range of lower settings (typically, 4K, 2K, 1K ohms) is required. These resistances are to be measured with the output high voltage applied.

7.7 Indicators

The presence of high voltage is to be indicated by an audio alarm or clearly visible lamp or meter on the control unit.

7.8 Tilt Switch

Where the pulse unit is carried by the operator during operation, a manual reset tilt switch is required that disables the machine when it is tipped past a maximum of 45° from vertical.

7.9 Connectors and Terminals

All connectors and terminals shall be rated for the voltage to be imposed on them.

Connectors used in association with multi-core flexible cords shall be of the locking variety, having an integral cord grip, that effectively removes any strain from the terminals.

High voltage single core cables must be terminated in a connector suitable for the conditions of its use, and be provided with a cord grip that removes any strain from the terminal.

All live conductors, including those forming part of the apparatus, shall be so insulated and further effectively protected where necessary, or so placed and safe-guarded as to prevent danger of electric shock.

Not allowed are: bare wire connections; metal tubes or coiled springs for cable strain relief; metal shrouds on plugs or sockets.

7.10 Protective Covers

Covers and the like must be securely fastened and mechanically robust. Covers which, on removal, expose live parts must be removable only with the aid of tools.

7.11 Operating Controls - Control Unit

Operating handles, levers, switches, and the like, shall comply to the requirements of double insulation to NZS 6200.

7.12 Conductors

All conductors used to connect the electrodes to their power source shall be of the highly flexible type, having, in addition to its functional layer of insulation, an additional layer to provide mechanical protection.

Conductors used to connect electrodes shall be in one continuous length and have continuous insulation between connection points of the electrode and cable reels or control unit.

In multicore cables, the insulation for each conductor within that cable shall be rated for the highest voltage carried by any one conductor and be protected against mechanical damage.

7.13 Batteries

Apparatus equipped with batteries containing liquid must be built in such a way that the insulation of the battery or of other parts cannot be affected by escaping liquid.

The battery must be so mounted that there is no danger of gases collecting or igniting.

The battery and its terminals must be insulated for the highest voltage that the machine can produce.

7.14 Protection from Water

All equipment must be protected to an IP rating in such a way that the safe operation of that equipment will not in any way be impaired when it is being used in the worst allowable conditions.

Hand electrodes and any attached switches shall be of a type with a minimum degree of protection IPX6 to AS 1939.

The control unit shall be of a type with a minimum degree of protection IPX4 to AS 1939.

7.15 Cable Reels

Apart from electrical connections, axle, and small fastening devices, the cable reel drum shall be constructed wholly from insulating materials, not prone to water absorption, breaking, or cracking.

Slip rings used on a cable reel shall be protected to IP23 to AS1939. All guards shall be constructed from suitable insulating material.

Minimum creepage distance between any live part and any other conductive part is 15 mm. The minimum air gap between any live part and any other conductive part shall be 12 mm. If any of these parts are free to move, they shall be set to the least favourable position for these measurements. The material used for insulation between these parts must be of a type resistant to dirt build-up and tracking.

Cables and connectors shall comply with specifications 7:9 and 7:12 of these specifications.

7.16 Supply Voltage

The maximum primary power source voltage to any electric fishing machine shall be 240 volts RMS.

When this voltage exceeds extra low voltage, only alternating current shall be used. This voltage is to be measured between the live conductors.

7.17 Generators

Maximum output voltage is 240 volts RMS.

The generator shall comply with AS 2790-1989, except for section 6.1.9 (b), (c), and (d) of that specification. Both of the active leads shall be isolated from the generator frame and any earth pin on the output socket. No current operated (core balance) earth-leakage device shall be used.

Where a low voltage output and an extra low voltage output are available simultaneously, they shall be from separate double insulated windings.

7.18 Nets

No net of any kind shall be attached to any electrode device.

All net handles shall be constructed of non-conductive material and shall be of sufficient length to avoid hand contact with the water. If these handles are made of wood or cane, they must be waterproofed with a suitable marine varnish. Wrapped or covered metal handles are not permitted.

No chain or leaded rope shall extend beyond or above the bottom edge of the net proper.

7.19 Electrode and Switch

Electrode poles shall comply with the requirements of NZS 6200. They shall be of sufficient length to avoid hand contact with the water. If the poles are made of cane, they must be waterproofed with a suitable marine varnish.

All anodes manipulated by hand shall be fitted with a switch that, when off, effectively removes all voltages higher than 12 volts from the electrode and its inter-connecting cable. This voltage is to be measured at an impedance of 20K ohms.

The switch operating lever shall be arranged in such a way that it cannot be held in an "on" position by the hand, or any part of the hand, being wrapped around the switch lever and the electrode handle together.

Operating handles, levers, switches, and the like shall comply to the requirements of double insulation of class 2, appendix B of NZS 6200 and have a minimum IP rating of 56. Terminals shall comply with specification 7.9 of these specifications.

8. REGULATIONS

The purchase, use, and repair of Electric Fishing equipment shall be as specified in the Freshwater Fisheries Regulations 1983.

9. REGISTRATION

Purchase and use of any electric fishing equipment is subject to a Certificate of Approval as described in FFR 1983, regulations 54 and 55.

10. ACKNOWLEDGEMENTS

The assistance of the Ministry of Commerce in defining these specifications is gratefully acknowledged.