

THE UNIVERSITY OF SUSSEX
SAFETY PROCEDURES AND GUIDANCE FOR THE
SAFE OPERATION OF
ELECTROPHORESIS APPARATUS
SPG-21-09 Revised 2009

A. INTRODUCTION

The Electricity at Work Regulations necessitates that the University must ensure that the electrical energy is safely contained. The voltage and power levels used during in general electrophoresis techniques are generally sufficient to cause injury or death. For example routine agarose gel electrophoresis running at 100 volts (V) can cause a lethal shock at a current of 25 milliamps (mA) and minor leaks in gel tank devices can result in electric shock.. Other techniques such as electroporation and electrotransformation, which also apply electricity to biological materials, may present a similar electrical hazard. The potential seriousness of an accident involving electrophoresis, or similar, apparatus should not be underestimated.

As a user of the apparatus you must only operate it in such a way that it is not a danger to yourself or anyone else in its vicinity. The aim of this document is to increase your understanding of the dangers and to prevent accidents. Please seek advice if any point is not clear to you.

B. LEGISLATION

(1) The Management of Health and Safety at Work Regulations

These Regulations require research supervisors and faculty in charge of equipment, including electrophoresis apparatus used in teaching and research, to list the hazards associated with the

The live parts of the sockets must not be inadvertently accessible. An integrity check of the cover must be performed before use.

(c) Apparatus that is not designed for use above 1000 volts must not be fitted with leads that can be plugged into a power pack capable of delivering more than 1000 volts. The use of adaptors which convert 4mm plugs to 2mm plugs is prohibited.

(d) During operation all electrophoresis apparatus should have prominently displayed safety warning signs to indicate that the equipment is 'live'.

(e) Electrophoresis apparatus **must** be operated within an approved interlocked enclosure. Where operation within an approved interlocked enclosure is not practicable, then the apparatus must only be used by trained, qualified faculty, technicians, post-doctorate or postgraduate research workers and closely supervised third year project students within a segregated and clearly defined area within the laboratory. **A copy of the risk assessment for each special electrophoresis area must be displayed within that area.**

5. High voltage cables

(a) All connecting cables between power packs and gel equipment must be fitted with shrouded connectors so that live parts are inaccessible. Stackable plugs must not be used. Both the cable and connectors must be correctly rated for the maximum voltage that the power pack can deliver in use.

(b) Electrophoresis sets fitted with their own set of permanently attached connector leads that eliminate jacks and plugs entirely are acceptable.

(c) Leads must be regularly inspected to ensure that there is no damage to insulation and that all parts of the conductor are covered.

(d) Leads must never be left connected to power packs when the electrophoresis run is complete.

Every electrophoresis apparatus must be accompanied by a **written** set of **operating instructions** to ensure that users are aware at all times of the safe procedure for operating the equipment.

Only approved designs of electrophoresis equipment may be manufactured in University of Sussex workshops. Designs are deemed to have been agreed only when written approval has been obtained from the School's '**designated person**' (see above).

H. CONTROL OF THE USE OF ELECTROPHORESIS EQUIPMENT

Training

Only trained individuals should be allowed to operate electrophoresis apparatus.

Supervisors are responsible for providing those under their supervision with appropriate

consideration of non-electrical hazards (e.g. chemicals), the requirement for personal protective equipment (lab coats, gloves, and eye protection), and any applicable emergency procedures.

Supervisors must ensure that these operational requirements are observed by routine checks on equipment and monitoring of procedures.

Departmental action

Departments should review the use of electrophoresis apparatus against the requirements of this policy. Particular attention should be paid to older equipment. Any equipment not conforming to this Policy Statement should be removed from service immediately.

Electrophoresis apparatus should be the subject of annual electrical testing and this should include testing of interlock function.

Supervisors must ensure that all electrophoresis apparatus has been risk assessed. They must develop a safe system of work for electrophoresis procedures and ensure their staff are given adequate training.

Water cooled gels

Whenever reasonably practicable, water cooled gels must also be operated within an approved interlocked enclosure. The Life Science workshops produce excellent interlocked enclosures for water cooled gels. It is therefore recommended that each water cooled or buffer recirculating apparatus is examined as an individual problem. If this approach is taken, it is anticipated that the workshops will be able to design an enclosure which is acceptable to the user, whilst at the same time achieving compliance with the Electricity at Work Regulations (see SPG-13-09) and with this document.

Electrophoresis apparatus - safe systems of work**Location**

- Apparatus should be located on non-conducting benches (e.g. solid laminate such as other laboratory activities.
- Unintentional grounding points and conductors should be avoided (e.g. sinks and other water sources, metal plates, aluminium foil, ~~11(.)-(4)-(sol)6~~)

	regulators, wherever possible, should be set at zero initially and increased gradually to the required voltage.
During operation	• Do not touch any cooling devices connected to a gel since current may be conducted through the tubing. • If buffer is spilled or leaks from the electrophoresis device, switch the power off to stop the run and clean the bench immediately. • Never disable safety interlock features and always follow the • Ensure that the fingers do not touch the metal casing of power packs to avoid completing a potential circuit to earth. • Use warning signs to alert others of the potential electrical hazard. • Never touch, interfere with, or move operating electrophoresis apparatus. • Electrophoresis apparatus should not be left running unattended routinely. • If equipment must operate overnight, for example, then it should be clearly identified with emergency contact information and succinct instructions for isolating the power supply
Postoperation	• Switch off the power pack BEFORE disconnecting both leads. Operators should wait 15 seconds (to ensure that internal capacitors have completely discharged) before making any disconnection and before removing the cover of the electrophoresis device and accessing the chamber. • The voltage regulator should be wound back to zero after a run and before • removing the leads. • Leads must always be removed from power packs when not in use.

I. SERVICING/MAINTENANCE OF ELECTROPHORESIS EQUIPMENT

Repair or testing may be undertaken only by **authorised persons** who have the appropriate **technical qualifications, experience and training** and who have received a written statement of authorisation which defines the limitations of their work. See Safety Procedures and Guidance for the Implementation of the Electricity at Work Regulations SPG-13-09

APPENDIX 1

Appointment and Duties of the 'designated person'

Appointment

Appointed in writing by the Technical Services Manager.

Duties

- (1) To advise on the risks to health from individual electrophoresis units.
- (3) To approve the design and construction of interlocked enclosures for electrophoresis apparatus (electrophoresis units).
- (4) To give written approval for designs of enclosures or electrophoresis equipment to be manufactured by the appropriate University workshop.
- (5) To approve the design of connecting leads, terminals and sockets between power pack and electrophoresis units.