



Complete Program Title: <b>Electrical Safety Program</b>	Risk Management Manual (RMM) Number: <b>316</b>
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<b>DISCLAIMER:</b> <i>If there is a discrepancy between this electronic program and the written copy held by the program owner, the written copy prevails.</i>	

## 1 PURPOSE

- 1.1 To define best practices for work involving electrical distribution systems and electrical equipment and tools.
- 1.2 To ensure compliance with the Occupational Health and Safety Act and the Ontario Electrical Safety Code.

## 2 SCOPE

- 2.1 All members of the McMaster community (faculty, staff, visitors, volunteers and students) who are required to work on or near electrical distribution systems and / or with electrical equipment and tools.
- 2.2 All contractors and subcontractors who are required to work on or near electrical distribution systems and / or electrical equipment and tools.

## 3 Related Documents

- 3.1 Occupational Health and Safety Act and Regulations
- 3.2 Ontario Electrical Safety Code O. Reg. 164/99

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- 3.3 NFPA 70E Standard for Electrical Safety in the Workplace (2009)
  - 3.4 CSA Standard CAN C22.2- Canadian Electrical Code
  - 3.5 McMaster University RRM # 100 Workplace & Environmental Health and Safety Program
  - 3.6 McMaster University RMM # 111 Contracting Work Safety Program/Due Diligence Program
  - 3.7 McMaster University RMM # 300 Safety Orientation and Training Program
  - 3.8 McMaster University RMM # 301 Standard Operating Procedures (SOP's) Program
  - 3.9 McMaster University RMM # 306 Lockout / Tagout Program
  - 3.10 McMaster University RMM # 304 Working Alone Program
  - 3.11 McMaster University RMM #325 Process and Equipment Purchase and/or Modifications
  - 3.12 McMaster University RMM # 317 Machine Shop Safety Program

#### 4 DEFINITIONS

- 4.1 **Authorized Person** – someone who has permission from the University to perform electrical work
- 4.2 **Competent Worker** – qualified electrician or an apprentice who worked directly under the supervision of a qualified electrician or a person with equivalent qualifications by training/experience
- 4.3 **Construction Project Safety Management Plan** – a written plan that shall describe compliance strategies for all applicable health and safety legislation, foreseeable job site hazards and precautionary measures, prerequisite employee safety training, safe work procedures, standard operating procedures (SOP's), first aid preparedness, stop work procedures, emergency response plans, incident reporting procedures, and the names and contact numbers of the job-site safety supervisor(s).
- 4.4 **Employer**- A person who employs one or more workers or contracts for the services of one or more workers and includes a contractor or subcontractor who performs work or supplies services and a contractor or subcontractor who undertakes with the owner, constructor, contractor or subcontractor, to perform work or supply services.
- 4.5 **Electrical Distribution Services** – equipment for the generation and distribution of electricity.
- 4.6 **Electrical Equipment** – includes any machine powered by electricity. It usually consists of an enclosure, a variety of electrical components, and often a power switch.
- 4.7 **Electrical Shock** – the effect produced on the body and in particular the nerves, by an electrical current passing through it. The magnitude of the shock depends on

current flow, usually measured in milliamperes (mA) rather than by Potential Difference (measured in volts). It is possible to have contact with extremely high potential difference with little current and have no injury occur in the voltage discharge.

- 4.8 **Ensure** – take every reasonable precaution to achieve the stated objective.
- 4.9 **Shall**—a legal term meaning must.
- 4.10 **High Voltage** – a voltage of six hundred volts or more between any two conductors and ground.
- 4.11 **Locked Out**—in respect of any electrical equipment, that the equipment has been de-energized and rendered inoperative and cannot be operated or be energized without the consent of the person who rendered it inoperative.
- 4.12 **Tagout** – a general term for all methods of ensuring the protection of personnel from uncontrolled energy sources by installing tags on energy isolating devices.
- 4.13 **Qualified Electrician** – a person who because of knowledge, training and experience, is licensed and otherwise qualified to perform work safely and properly in the Province of Ontario.
- 4.14 **Safety Watcher** – a person who is authorized to stop work immediately in the event of danger, and who is trained in emergency procedures including first aid and CPR.
- 4.15 **Standard Operating Procedures** – Written procedures required by the OHSA under specific regulations and by McMaster University Programs that define the techniques, processes and best practices required to prevent injury and/ or occupational illness or damage to University equipment or the environment.
- 4.16 **Supervisor** – Person who has charge of a workplace or authority over a worker.
- 4.17 **Technical Specialist (Electrical)** – Person responsible for the provision of support and direction regarding the maintenance and installation of electrical services and equipment on campus (See Section 5.4).
- 4.18 **Worker** – any of the following:
  - 1. A person who performs work or supplies services for monetary compensation.
  - 2. A secondary school student who performs work or supplies services for no monetary compensation under a work experience program authorized by the school board that operates the school in which the student is enrolled.
  - 3. A person who performs work or supplies services for no monetary compensation under a program approved by a college of applied arts and technology, university, private career college or other post-secondary institution.
  - 4. A person who receives training from an employer, but who, under the Employment Standards Act, 2000 (ESA), is not an employee for the

purposes of that act because the conditions set out in subsection 1 (2) of that act have been met.

5. Other persons who work or provide services to an employer for no money, who may be prescribed by regulation.

4.19 **Constructor** – a person who undertakes a project for an owner and includes an owner who undertakes all or part of a project by himself / herself or by more than one employer; also called the general or prime contractor. The constructor has complete control of the work on behalf of the construction project owner, and has responsibility for regulatory compliance and safe work procedures on the job site.

#### 4.20 **Acronyms:**

**CSA** – Canadian Standards Association

**CJHSC** – Central Joint Health and Safety Committee

**CPR** - Cardio-Pulmonary Resuscitation

**EOHSS** – Environmental and Occupational Health Support Services

**ESA** – Electrical Safety Authority

**FHSSO**– Faculty of Health Science Safety Office

**GFCI** – Ground Fault Circuit Interrupter; protects against electrical leakage shocks.

**JHSC** – Joint Health and Safety Committee

**LOTO** – Lockout /Tagout

**MOL** – Ministry of Labour

**OHSA** - Occupational Health and Safety Act

**RMM** – Risk Management Manual

**SOP** – Standard Operating Procedure

## 5 **RESPONSIBILITIES**

### 5.1 **Role of Senior Managers (Directors / Deans / Chairs / Department Managers):**

Senior Managers shall:

- provide the resources and direction necessary to support and maintain an effective Electrical Safety Program; and
- ensure all electrical work within their area of responsibility is carried out in compliance with McMaster University's Health and Safety Policy and Programs.

## 5.2 Role of Facility Services:

Facility Services shall:

- ensure that the design, construction, installation and inspection of electrical distribution services meet the standards of the Ontario Electrical Safety Code;
- ensure the operation and maintenance of electrical distribution services meet the standards of the Ontario Electrical Safety Code, all other applicable codes and safety standards;
- ensure that plans and specifications for new electrical facilities and major alterations are submitted to the appropriate municipal and/or provincial agencies for review and approval;
- ensure that only contractors approved as prescribed under McMaster University RMM # 111 Contracting Work Safety – Due Diligence Program are authorized to service and / or install electrical distribution services and equipment;
- ensure that only qualified electricians or an apprentice who works under the direct supervision of a qualified electrician or a person with equivalent qualifications by training and experience shall connect maintain or modify electrical equipment or installations
- ensure that energized parts of electrical circuits and service equipment are guarded by approved cabinets or enclosures;
- ensure that electrical disconnect switches and circuit breakers are labeled and that access to such switches and control devices is unobstructed (1 m clearance);
- ensure that ground fault circuit interrupters (GFCI's) are installed on temporary circuits at renovation and construction sites;
- ensure that all new electrical installations are inspected by the ESA; and
- ensure Utility Services is contacted for underground locates by contacting Facility Services Customer Service;
- provide direction and support to ensure compliance with the McMaster University RMM # 306 Lockout / Tagout Program for work on the electrical systems and related equipment;
- provide SOP's as required for work related to the servicing and replacement of all components of the electrical distribution system on campus;
- develop technical service standards for work on electrical systems and equipment;
- determine technical training needs for all staff authorized to work on electrical systems and equipment;
- coordinate services provided by hydro providers and independent electrical service providers for work on high voltage systems.

**5.3 Role of Constructor / Contractor (NB: This includes University departments that assume the role of a constructor while acting as an owner or employer) when installing and or servicing electrical systems and equipment:**

Constructor and Contractors shall:

- be a qualified constructor/contractor approved through the formal preapproval process, i.e. QCSolver
- as part of their contract agree to comply with all applicable health and safety legislation environmental protection legislation, Municipal Bylaws, industry standards;
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- as part of the tendering process submit a **Construction Project Safety Management Plan** that is designed to address all of the risks associated with the project (See definition in Section 1 of this Program);
- ensure that the design, construction, installation and inspection of electrical distribution services meet the standards of the Ontario Electrical Safety Code;
- comply with all relevant McMaster University programs as defined in the McMaster University Risk Management Manual and all relevant McMaster University Building and Design Standards;
- ensure that only qualified electricians or an apprentice who works under the direct supervision of a qualified electrician or a person with equivalent qualifications by training and experience shall connect maintain or modify electrical equipment or installations
- ensure that ground fault circuit interrupters (GFCI's) are installed on temporary circuits at renovation and construction sites;
- provide ESA inspection certificates for all electrical installations; and
- obtain a Utility Services Underground Services Locate Permit from Facility Services prior to any excavation on McMaster University property.

**5.4 Role of Facility Services Technical Specialist (Electrical):**

The Facility Services Technical Specialist (Electrical) shall:

- provide technical assistance to the campus for items related to the electrical distribution services, electrical training and electrical safety.

**5.5 Role of Supervisors:**

Supervisors shall:

- be qualified to supervise work involving the installation, modification, adjustment, testing or repair of electrical distribution systems;

- ensure that only qualified electricians or an apprentice who works under the direct supervision of a qualified electrician shall install, modify, adjust, test or repair electrical distribution systems;
- consult with Facility Services, as necessary, on work involving electrical systems and/or electrical equipment;
- ensure that electrical equipment that is capable of becoming live is de-energized, locked out, tagged and tested before work is performed on the equipment (See McMaster University RMM # 306 Lockout / Tagout Program);
- ensure that all electrical testing equipment is readily available and maintained in good working order;
- ensure that when equipment cannot be locked out, a written SOP including, tagout, testing and competent worker standby is developed to provide an equivalent level of safety to that provided by a lockout procedure, and this SOP is reviewed by EOHSS;
- take measures to protect workers from injury when work must be performed near live electrical equipment;
- appoint safety watchers when work must be done near live electrical equipment
- ensure that electrical tools and equipment used in damp or outdoor environments are protected by ground fault interrupters (GFCI's);
- ensure locates are performed for underground services by contacting Facility Services Customer Service;
- ensure that electrical equipment is maintained in safe working order; and
- ensure that all electrical equipment and appliances have CSA, ESA or equivalent inspection agency approval **prior to installation** and/or use RMM#325 Process and Equipment Purchase and/or Modifications.

#### 5.6 Role of Authorized Individuals:

Persons authorized to undertake work involving the installation, modification, adjustment, testing or repair of electrical distribution systems and equipment shall:

- be qualified and certified to undertake work involving the installation, modification, adjustment, testing or repair of electrical distribution systems;
- observe all safety rules and best practices related to work involving the installation, modification, adjustment, testing or repair of electrical distribution systems;
- work in compliance with all SOP's for work involving the installation, modification, adjustment, testing or repair of electrical distribution systems;

- ensure that electrical equipment that is capable of becoming live is locked out, tagged and tested before work is performed on the equipment (See McMaster University RMM # 306 Lockout / Tagout Program);
- follow the written procedures outlined in SOP's for work on electrical equipment that cannot be locked out, including tagout, testing and safety watcher standby;
- wear protective equipment and clothing as prescribed for work involving the installation, modification, adjustment, testing or repair of electrical distribution systems;
- report all unsafe electrical conditions and / or equipment; and
- report to the supervisor all injuries and incidents having the potential to injure or damage equipment.

#### **5.7 Role of Environmental and Occupational Health Services (EOHSS) and Faculty of Health Sciences Safety Office (FHSSO):**

The EOHSS and/or FHSSO Safety Office shall:

- update the Electrical Safety Program as required by new legislation and/or best practices;
- provide advice regarding the development of SOP's for work involving the installation, modification, adjustment, testing or repair of electrical distribution systems;
- provide Basic Electricity training; and
- conduct periodic audits of the effectiveness of Electrical Safety Program.

#### **5.8 Role of the Joint Health and Safety Committee**

The JHSC shall:

- review SOP's related to work involving the installation, modification, adjustment, testing or repair of electrical distribution systems upon request;
- assess the effectiveness of the Program as part of the safety inspection process.

#### **5.9 Role of the Central Joint Health and Safety Committee:**

The CJHSC shall:

- review and make comment on the Electrical Safety Program on scheduled basis.

## **6 PROCEDURES**

### **6.1 Work Procedures**



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- 6.1.1 The safety regulations and electrical equipment standards for insulating materials and conductors as outlined under **O. Reg. 851, RRO 1990 Industrial Establishments, Sections 40, 41, 42, 43, 44, and O. Reg. 213 / 91 Construction Projects, Sections 181– 195** shall be deemed to be minimum standards of protection for work involving such equipment and materials.
  - 6.1.2 Operation and maintenance of electrical distribution systems and equipment shall meet the standards of the Canadian Electrical Safety Code.
  - 6.1.3 All electrical distribution services and equipment must be designed, installed and inspected in accordance with the Ontario Electrical Safety Code.
  - 6.1.4 All electrical equipment, materials, tools and appliances must be CSA or Canadian equivalent approved.
  - 6.1.5 Arrangements shall be made through Facility Services for inspection and approval of electrical equipment by hydro provider or an ESA safety inspector.
  - 6.1.6 Prior to any excavation on McMaster University property a permit must be obtained from Facility Services.
  - 6.1.7 Electrical equipment that is capable of becoming live shall be isolated, locked out, tagged and tested before work is performed on the equipment. (See RMM # 306 Lockout / Tagout Program).
  - 6.1.8 When equipment cannot be locked out, a written SOP (including tagout, testing, safety watcher standby and emergency procedures shall be developed and implemented to provide an equivalent level of safety to that provided by a lockout procedure (See RMM # 301 Standard Operating Procedures (SOP's) Program).
  - 6.1.9 An SOP must be provided for all work performed near live electrical equipment (See RMM # 301 Standard Operating Procedures (SOP's) Program)
  - 6.1.10 Working alone is prohibited on energized lines or equipment that exceeds 300 volts (See RMM # 304 Working Alone Program).
  - 6.1.11 Safety watchers must be provided for all work performed near live electrical equipment.
  - 6.1.12 Electrical disconnect switches and circuit breakers shall be labeled. Access to electrical switches, control devices and meters shall be unobstructed.
  - 6.1.13 GFCIs shall be used to provide electrical safety outdoors or in damp environments, and 6ft from indoor water sources. In addition to protecting against leakage problems with extension cords and power tools GFCs protect against ground faults caused by improper wiring when electrical plugs are replaced
  - 6.2 **Certification and Training**
  - 6.2.1 No worker shall install, modify, adjust, test, or repair electrical distribution services unless the worker is a qualified electrician or an apprentice working under the direct supervision of a qualified electrician.

- 6.2.2 All workers required to work on or near electrical systems and or equipment must be trained and certified in Lockout / Tagout procedures ((See RMM # 306 Lockout / Tagout Program).
- 6.2.3 Individuals required to work regularly around energized electrical equipment or distribution systems shall be trained and qualified in cardio-pulmonary resuscitation (CPR).

## **7 RECORDS**

- 7.1 To facilitate internal audits and audits by regulatory agencies e.g. Ministry of Labour, copies of all SOP's must be retained by supervisor for a minimum of three years for work involving lockout and or work on live electrical systems or equipment.