



SPECIFICATION

Electrical Safety for Tower Cranes

ESA SPEC-009 R0

The Electrical Safety Authority
Reaffirmed July 8, 2022

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1 Introduction

1.1 Scope

This document describes minimum levels for the electrical safety of the equipment and wiring on tower cranes for the purpose of complying with the requirements of the Occupational Health and Safety Act enforced by the Ministry of Labour, Training and Skills Development (MLTSD) of Ont. Reg. 213/91. This document does not override obligations to comply with the Occupational Health and Safety Act, R.S.O. 1990, c. O.1

1.2 Objectives

The document will provide the *Review Engineer* with information for reviewing and inspecting the electrical system pre and post erection of the tower crane including ensuring:

- approval of electrical equipment including wiring;
- damaged or worn equipment due to harsh weather conditions, lack of maintenance and use in the construction environment will present no undue electrical safety hazards;
- damaged or worn equipment is repaired/replaced/maintained in a timely safe manner; and
- fire and shock hazards related to the tower crane installations are addressed.

This document is not intended to prescribe:

- electrical performance requirements;
- electrical wiring on the line side of the disconnecting means that is covered under the jurisdiction of the *Electrical Safety Authority (ESA)*;
- requirements for tower cranes intended for use in whole or part within an area classified as a hazardous location as defined in the Ontario Electrical Safety Code (OESC).

Where no specific rules or requirements are referenced, the requirements of the current version of the OESC shall apply.

1.3 Background

In Ontario, OESC Rule 2-022 1) indicates that no person shall use, advertise, display, sell, offer for sale or for other disposal any electrical equipment unless it has been *approved* in accordance with Ontario Regulation 438/07. However, a lack of an electrical certification standard for tower cranes makes it impractical for them to be *approved* as an assembly often leaving sections or the interconnecting wiring between the sections unapproved and without review.

2 Referenced Publications

This document refers to the following publications, and where such reference is made, it shall be to the current version of the standards and regulations listed below including all amendments published thereto.

Ontario Regulation 164/99- Ontario Electrical Safety Code (OESC)

CSA SPE-1000- Model Code for the Field Evaluation of Electrical Equipment

CAN/CSA - CSA 22.2 NO. 14- Industrial Control Equipment

CAN/CSA - C22.2 No 5- Molded-Case Circuit Breakers, Molded-Case Switches and circuit-breaker enclosures

CAN/CSA - C22.2 NO. 235- Supplementary Protectors

CAN/CSA Z248 Code for Tower Cranes

Electricity Act, 1998

EN 14439:2006+A2- Cranes – Safety – Tower Cranes

Ontario Regulation 213/91 Construction Projects- Ontario Occupational Health and Safety Act

Ontario Regulation 438/07- Product Safety

Professional Engineers Ontario Practice Standard- Review of Tower Cranes as Required by the Occupational Health and Safety Act

UL 1077- Supplementary Protectors for Use in Electrical Equipment

3 Definitions

Approved — *Approved* in accordance with Ontario Regulation 438/07 by:

- a. A *Certification organization* and bear a certification mark; or
- b. A *Field Evaluation Agency* and bear a field evaluation mark.

Certification organization — a “Certification Body” as defined in Ontario Regulation 438/07 and a body accredited in accordance with the Standards Council of Canada Act (Canada) to evaluate electrical equipment and is recognized by the *Electrical Safety Authority (ESA)*.

Connection Authorization —

- a) when concerning supply of electrical energy to an electrical installation from a supply authority, signifies written permission by the ESA to a supply authority, or any other person or corporation, to supply electric energy to a particular electrical installation; and
- b) when concerning supply of electric energy from one part of an electrical installation to another, or from a source of electric energy other than that of a supply authority, signifies permission from the ESA to a contractor to connect a particular electrical installation or part thereof to a source of electric energy.

Disconnecting means — a device, group of devices, or other means whereby the conductors of a circuit can be disconnected from their source of supply.

Electrical Safety Authority (ESA)- the sole administrative authority for the purposes of administering the provisions of the Electricity Act, 1998 and the regulations made under that Act that are designated legislation under section 1. O. Reg. 187/09, s. 2.” in accordance with Ontario Regulation 187/09.

Field Evaluation Agency —as defined in Ontario Regulation 438/07, an inspection body accredited in accordance with the Standards Council of Canada Act (Canada) to evaluate electrical equipment and is recognized by the *ESA*.

Review Engineer (as defined in the PEO practice standard for tower cranes)

means a holder of a licence or a temporary licence to practise professional engineering who is carrying out the work described in s. 2*;

*Section 2 of the Practice Standard for Tower Cranes refers to:

- Review of tower cranes prior to erection;
- Pre-erection inspection;
- Review of tower cranes after erection; and
- Inspection before tower climbing operations.

4 Approval

4.1 Requirements (See Appendix B)

Electrical equipment such as control panels, or sections of a tower crane containing electrical equipment that is disassembled as a unit such as operators cab shall be *approved or meet the equivalent standards of 4.1.1*

4.1.1 Equivalent Standards of Approval

When applying equivalent standards, the following method shall be acceptable:

4.1.1.1 Tower Cranes Built to EN14439

(See Appendix A and B)

Tower cranes manufactured in accordance with European Standard EN14439 with the following modifications verified by the *Review Engineer*:

- i) All supplementary protectors have appropriate upstream overcurrent protection as required by OESC Rule 14-114 “Application of Supplementary Protectors”;
- ii) All Manual Motor Controllers are *approved* to CSA 22.2 NO. 14 Industrial Control Equipment or equivalent; and
- iii) All electrical devices and wiring are designed, manufactured and installed as intended for the specific application.

5 Review

5.1 Pre Erection

Prior to assembling, an onsite review of the tower crane and its interconnecting wiring should be performed and documented by a *Review Engineer* for:

- compliance with Section 4 of this document;
- damage / wear or any signs of electrical safety hazards

5.2 Post Erection

(See Appendix B)

A review of the assembled tower crane sections and the interconnecting wiring methods should be completed by a *Review Engineer* or a designated person delegated by the *Review Engineer* to verify compliance with this document.

6 Wiring **(See Appendix B)**

6.1 Interconnecting Wiring

The *Review Engineer* should verify the following sub-sections are complied with pre and post erection of the tower crane.

6.1.1 Approved Wiring

Wiring shall be *approved* as per Section 4.1 of this document or meet the equivalent requirements of sub-section 4.1.1, and shall be suitable for the specific condition of use and meet the location requirements with respect to, but not limited to:

- (a) moisture;
- (b) corrosive action;
- (c) temperature;
- (d) degree of enclosure;
- (e) exposure to mechanical injury;
- (f) flexibility and suitability for frequent erection and disassembly; and
- (g) sunlight resistance.

6.1.2 Unapproved Wiring

Notwithstanding sub-section 6.1.1, when wiring is not *approved*, the *Review Engineer* may choose to accept it on a temporary basis provided the wiring will not present a safety hazard for the length of the scheduled deployment during normal operation and exposure to the elements.

6.1.3 Flexible Cords Installation and Support

Flexible cords shall be supported so that no damaging strain is imposed on the terminals of any electrical apparatus or devices, joints or taps. Flexible Cords installed vertically shall be supported independently of the terminal connections, and such supports shall not cause damage to the conductors or their coverings. Support shall be installed in such a manner as to permit expansion and contraction of the cable and facilitate flexibility where required.

6.1.4 Connections

Conductors shall enter enclosures using connectors *approved* for the purpose as per manufactures requirements.

6.1.5 Enclosures

6.1.5.1 Enclosure Suitability

Where provided for termination, the mounting and protection of control components, or live parts, enclosures shall be *approved* for the application in accordance with OESC Rule 2-400 "Enclosures, type designations, and use".

6.1.5.2 Enclosure Marking

All enclosures shall be marked in accordance with OESC Rule 2-402. Enclosures shall be labelled with caution and warning markings in accordance with the requirements of SPE1000 Section 5 Marking.

7 Bonding

The tower crane structure shall be bonded to the electrical system with a conductor sized in accordance with Table 16 of the OESC based on the ampere rating or setting of the overcurrent device supplying the crane.

8 Crane Lightning Protection

When lightning protection is installed, it shall also comply with OESC Rule 10-108 which requires the grounding electrode to be solely dedicated for the lightning system protection including the down conductors. The lightning system protection shall not be used for grounding electrical equipment or electrical systems.

9 Disconnecting Means

(See Appendix A and B)

Suitable means for disconnecting all ungrounded conductors of the circuit simultaneously shall be:

- (a) Provided within 9.0m and within sight of the section where the power enters the tower crane;
- (b) Accessible and operable from the ground;
- (c) Permanently marked "MAIN CRANE DISCONNECT"; and
- (d) Capable of being locked in the open position.

10 Marking

A permanent label on or adjacent to the tower crane's main disconnect at the base of the tower crane shall indicate:

- Operating Voltage;
- Number of Phases and wires (ie: 3 phase , 4 wire);
- Minimum Supply Circuit Current
- Equipment short circuit capacity rating; and
- any other marking necessary to ensure safe connection to a power source

11 Log Book

The owner, owner's agent, and operator shall maintain a record in the crane log book of all electrical work on the crane.

11.1 Contents

The log shall contain, but is not limited to, documentation of:

- All pre and post erections; and
- All additions, repair and or replacement of electrical wiring, equipment or components.

12 Maintenance

The tower crane shall be monitored and maintained to ensure damaged or worn equipment will present no undue electrical safety hazards. Identified issues will be repaired or replaced in a timely safe manner and logged in the tower crane's log book.

12.1 Repair or Replacement

When electrical equipment contained within the tower crane requires repair or replacement of components, the sections shall be:

- *Re-approved* in accordance with Section 4 of this document; or
- When the repair or replacement does not alter the electrical rating or the characteristics of the equipment, the repair shall be entered into the log book.
- When the repair or replacement alters the electrical rating or characteristic of the equipment, the equipment will need to be *re-approved*.

13 Connection Request

(See Appendix B)

A *connection authorization* shall be required from ESA per OESC Rule 2-012 for the work up to the disconnecting means identified in Section 9 of this document prior to supplying energy to a tower crane. Except as permitted by 13.1 the disconnecting means shall be locked in the open position until the *Review Engineer* has completed their review of the tower crane's electrical system and confirmed it meets the requirements of this document.

13.1 Temporary Use

A tower crane shall be permitted to be energized for those operations required to ready the tower crane for service.

14 Appendix (A) – Additional Requirements

This Appendix is a normative (mandatory) part of this document

Section 4.1.1.1(i) Supplementary protectors shall not be used for short-circuit or overload protection for motors.

Supplementary protectors shall not be used where feeder or branch circuit protection is required by the OESC.

9.0 Disconnecting Means

The incoming supply to the tower crane including the installation of the trench, raceway, conductors, etc. up to the disconnect switch shall be installed in compliance to the OESC, and will require a notification of work as per OESC Rule 2-004.

15 Appendix (B) – Clarifications of Requirements of this Specification

This Appendix is an informative (non-mandatory) part of this document

Section 4.1 Recognized Certification Marks and Field Evaluation Agencies

For current recognized Certification Agencies and Field Evaluation Agencies, visit the Electrical Product Safety section of www.esasafe.com

Although there is not a certification standard for tower cranes, an evaluation of the electrical system to the requirements of this document by the *Review Engineer* is considered sufficient to ensure electrical safety. The documentation shall include alternate referenced equivalent standards; or standards where test data detailing equivalency is provided.

Sections 4.1.1.1(i) Supplementary Protectors are devices that may be similar in appearance to a small circuit breaker, but THEY ARE NOT A CIRCUIT BREAKER. Circuit breakers are tested to CSA standard C22.2 No 5 or UL 489, whereas supplementary protectors are tested to standard C22.2 No 235 or UL 1077.

Supplementary protective devices suitably rated for the purpose intended may be used as follows:

(a) Supplementary fuses may be used in the secondary circuits of control transformers, provided that the fuse is installed in a fuse holder and the controller is marked (see**); and

(b) A supplementary protector may be used in the secondary circuits of control transformers, provided that the primary protection of the transformer is sized to provide the short-circuit protection required for the supplementary protector, when applicable

provided that the supplementary protector has a short-circuit application code of U2, or U3.

**There shall be a marking near a fuse holder specifying the voltage and current rating of the replacement fuse. The marking shall also indicate the designation of the fuse but may also include the words "OR EQUIVALENT".

Note: A fuse legend or directory permanently affixed within the panel will satisfy the requirement.

Section 4.1.1.1(ii) Manual Motor Starters (MMS) are modular devices that are used to provide overload protection for motors. Some of the newer units are now certified for group fusing. These applications are those in which a single overcurrent device provides the instantaneous short circuit protection for a group of motors, where an MMS provides the individual overload protection. This new device allows for more compact panel designs.

MMS marked "Suitable for Motor Disconnect" is permitted to be used as both starter and disconnecting means. MMS **not** marked shall **not** be used as a disconnecting means.

The MMS are UL and CSA tested and certified (CSA 22.2 No.14) for motor overload protection only. They have not been certified for use as overcurrent protection for other equipment such as, Transformers, Servos controllers, Variable Frequency Drives (VFD) controllers, power supplies etc.

The European marketplace uses them extensively for all of the above. This causes a conflict when equipment is imported into North America.

Section 4.1.1.1(iii) Electrical equipment shall only be used and installed in a manner prescribed by the manufacture. For example switches installed exposed to the weather, shall be designed and *approved* for that purpose.

9.0 Disconnecting Means

The separation point (demarcation) between the tower crane and the incoming supply conductors shall be the line side of the tower crane's main disconnect switch.