

## STANDARD INFORMATION

**Standard:** CSA C22.2 No. 301

**Standard ID:** Industrial Electrical Machinery [CSA C22.2#301:2023 Ed.2]

**Previous Standard ID: Industrial:** Electrical Machinery (R2021) [CSA C22.2#301:2016 Ed.1]

## EFFECTIVE DATE OF NEW/REVISED REQUIREMENTS

**Effective Date:** **September 1, 2025**

## IMPACT, OVERVIEW, AND ACTION REQUIRED

**Impact Statement:** Per our accreditation, Intertek is required to review reports against the standard revisions to confirm compliance. Once compliance is confirmed, the standard reference in the report is updated to show continued compliance to the technical requirements of the standard. Reports not updated to this version by the effective date above will be withdrawn.

**This standard contains changes to functional safety requirements. See Clauses 9 and 9.15.**

### Overview of Changes:

- Expansion of Scope to include industrial robots and industrial robotics equipment
- Revisions and clarifications of existing requirements
- Introduction of new requirements for industrial robotics and industrial robotics equipment
- Introduction of new construction requirements related to temperature, enclosures, insulating materials, electrical spacings, and wet or outdoor locations
- Introduction of new electrical supply requirements, such as requirements for terminations, batteries, and battery circuits
- Revisions to equipment protection requirements and the introduction of surge protections applicable to industrial machineries
- New bonding requirements for non-metallic enclosures
- New marking requirements for wiring terminals
- New type test requirements for battery overcharge test, breakdown components test, strain relief test, flexing test, and stability test
- Additional requirements for industrial robots and industrial robotic equipment

Specific details of new/revise requirements are found in table below

***Current Listings Not Active? – Please immediately identify any current Listing Reports or products that are no longer active and should be removed from our records. We will do this at no charge as long as Intertek is notified in writing prior to the review of your reports.***



## STANDARD INFORMATION

CLAUSE	VERDICT	COMMENT
		<i>Additions to existing requirements are <u>underlined</u> and deletions are shown <del>lined-out</del> below.</i>
1	Info	<b>Scope</b>  This Standard applies to industrial electrical machinery comprising interconnected mechanical, electrical, or electronic equipment, <u>including industrial robots and industrial robotic equipment</u> operating in a co-ordinated manner.
1.1		<b>Notes:</b> <u>1) Examples of industrial electrical machinery covered by this Standard include handling and assembly machines, machines for packaging, factory automation machines, and inspection machines, as well as machine tools and machines for woodworking.</u> <u>2) This equipment is sometimes referred to as a skid.</u>
1.2		This Standard applies to equipment  a) rated at not more than 1000 V ac <u>or 1500 V dc</u> ; and b) intended to be installed and used in non-hazardous locations in accordance with the Canadian Electrical Code, Part I.
1.7		This Standard does not apply to self-propelled work platforms <u>or on-road vehicular machineries.</u>  <b><i>New clause added;</i></b>
1.8		This Standard does not apply to motor-operated appliances or equipment covered by CSA C22.2 No. 68 for household, commercial cord-connected, industrial cord-connected, rechargeable battery-operated, or permanently connected use.
4	Info	<b>Construction requirements</b>
4.1	Info	<b>General</b>  <b><i>New clause added;</i></b>
4.1.4		Industrial electrical machinery shall be assigned a short circuit current rating in accordance with Clause 4.13 in CSA C22.2 No. 286.  <b><i>New clause added;</i></b>
4.1.9		Machinery shall be designed to comply with applicable Industry Canada regulations (e.g., Industry Canada ICES-001 or ICES-003, or Annex E).



CLAUSE	VERDICT	COMMENT
		<b><i>New clause added;</i></b>
4.1.10		Pressure vessels and parts as defined in the Act shall conform to the Act and provincial regulations. These vessels and parts shall bear a CRN (see CSA B51).
		<b><i>New clause added;</i></b>
		Products incorporating lasers shall conform to the applicable requirements found within:
4.1.11		a) ANSI Z136.1 and ANSI Z136.9; b) CSA E60825-1 and IEC 60825-4; c) CSA Z142; d) CSA Z432; e) CSA Z434; or f) ISO 11553-1.
4.3	Info	<b>Temperature</b>
		<b><i>New clause added;</i></b>
		Industrial electrical machinery devices and components shall be installed and used in accordance with the manufacturer's installation instructions. With respect to thermal operating conditions, considerations shall be given to
4.3.1		a) ambient temperature rating of the industrial electrical machine; b) enclosure heat dissipation capability; c) enclosure material; d) thermal contribution from other installed components (e.g., transformers, reactors, fuses, etc.); and e) temperature ratings of individual components.
		<b><i>New clause added;</i></b>
4.3.2		Notwithstanding the requirements of Clause 4.3.1, compliance may be determined by conducting the temperature test as specified in CSA C22.2 No. 286.
4.4	Info	<b>Enclosures</b>
		<b><i>New clauses added;</i></b>
4.4.14- 4.4.28		See standard for details.
		<b><i>New section added;</i></b>
4.5		<b>Insulating materials</b>
		See standard for details.



CLAUSE	VERDICT	COMMENT
		<b><i>New section added;</i></b>
4.6		<b>Electrical spacings</b>  See standard for details.
		<b><i>New section added;</i></b>
4.7		<b>Machinery intended for wet locations</b>  See standard for details
		<b><i>New section added;</i></b>
4.8		<b>Machine intended for outdoor locations</b>  See standard for details.
5	Info	<b>Electrical supply</b>
5.2	Info	<b>Terminations</b>
		<b><i>New clause added;</i></b>
5.2.2		Industrial machinery shall be provided with wiring terminals for the connection of conductors having an ampacity not less than the larger of the following:  a) the ampere rating of the device; or b) 125% of the full-load motor-running current specified in CSA C22.2 No. 286 Table 2 or 3 for the horsepower rating of motor(s) used within the equipment.
		<b><i>New clause added;</i></b>
5.2.3		Terminal parts for field-wiring connections shall meet the requirements of CSA C22.2 No. 0 except  a) ferrous binding head screws, bolts, studs, nuts, and washers may be used if suitably protected with a plating of zinc or equivalent material having a thickness not less than 0.005 mm; and b) for a No. 10 AWG or smaller conductor, the terminal to which wiring connections are made may consist of clamps or binding screws with a terminal plate having upturned lugs or the equivalent to hold the wires in position.
		<b><i>New clause added;</i></b>
5.2.4		A wire-binding screw to which field-wiring connections are made shall be not smaller than No. 8 except  a) a No. 5 screw may be used at a terminal intended only for connection of a No. 14 AWG or smaller conductor; and b) a No. 6 screw may be used at a terminal intended only for connection of a No. 12 AWG or smaller conductor.



CLAUSE	VERDICT	COMMENT
		<b><i>New clause added;</i></b>
5.2.5		A terminal plate tapped for a wire-binding screw shall be of metal not less than 0.75 mm thick for a No. 14 AWG or smaller wire, and not less than 1.25 mm thick for a wire larger than No. 14 AWG. There shall be no fewer than two full threads in the plate. Two full threads shall not be required if fewer threads result in a secure connection in which the threads will not strip upon application of a 2.3 N•m tightening torque.
		<b><i>New clause added;</i></b>
5.2.6		A terminal plate formed from stock having the minimum required thickness specified in Clause 5.2.5 may have the metal extruded at the tapped hole for the binding screw to provide two full threads.
5.5		<b>Excepted circuits</b>
		The following excepted circuits need not be disconnected by the main supply circuit disconnecting device and may employ their own disconnecting device:
5.5.1		a) lighting circuits used to provide lighting for maintenance purposes; b) plugs and receptacles used exclusively to connect maintenance tools and test equipment; c) undervoltage protection circuits that are used solely for automatic tripping in the event of a supply circuit failure; d) <u>electromagnetic interference (EMI) filters;</u> e) <u>surge protective devices (SPDs); and</u> f) circuits supplying equipment that should normally remain energized for correct operation ( <u>e.g., temperature-controlled measuring devices, heaters, program storage devices</u> ).
		<b><i>New section added;</i></b>
5.7		<b>Batteries and battery circuits</b>
		See standard for details.



CLAUSE	VERDICT	COMMENT
7	Info	<b>Equipment protection</b>
		<b>General</b>
		Measures shall be provided to protect equipment against the effects of
7.1		a) overcurrent arising from a short circuit; b) overload and/or loss of cooling of motors; c) abnormal temperature; d) loss of or reduction in the supply voltage; e) overspeed of machines/machine elements; f) ground fault/residual current; g) incorrect phase sequence; and h) overvoltage due to lightning and switching surges; and i) <u>non-electrical hazards.</u>
		<u>Note: Non-electrical hazards are addressed in CSA Z432 and CSA Z434.</u>
7.2	Info	<b>Overcurrent protection</b>
7.2.3		All ungrounded conductors shall be protected by an overcurrent protective device at the point where they receive the supply current and at each point where there is a reduction in the cross-sectional area of the conductors or another change reduces the current-carrying capacity of the conductors. <u>The marking details shall be as described in Clause 17.4.4.</u>
		<b><i>New section added;</i></b>
7.4		<b>Surge protection</b>
		See standard for details.
7.5	Info	<b>Transformer protection</b>
		<b><i>New clause added;</i></b>
7.5.4		Any transformer that has not been previously evaluated and whose failure would result in a thermal or electric shock hazard shall be subjected to the overload test in accordance with CSA C22.2 No. 66.2.
8	Info	<b>Bonding</b>
8.1	Info	<b>General</b>
8.1.1		<del>Bonding is a basic fault protection provision that allows for the protection of persons against electric shock from indirect contact.</del>
		<u>Industrial electrical machinery shall comply with CSA C22.2 No. 0.4.</u>
		<b><i>New section added;</i></b>
8.5		<b>Bonding for non-metallic enclosures</b>
		See standard for details.



CLAUSE	VERDICT	COMMENT
		<b>Control circuits and control functions</b>
		Notes:
9		<p>1) Safety control functions may be implemented through the use of hardware or by a combination of hardware and software. In addition to the requirements of this Standard, <u>other relevant functional safety documents such as CSA C22.2 No. 0.8, ISO 13849-1, ISO 13849-2, or IEC 62061</u> specify the requirements for these safety functions and should be consulted in combination with this Standard.</p> <p>2) See CSA Z432 for additional information about safeguarding of machinery.</p> <p>3) <u>Products for use within a safety control function may be assessed to the CSA C22.2 No. 61508 series of standards.</u></p>
		<b><i>New clause added;</i></b>
		<b>Control function performance</b>
9.15		<p>Compliance with performance requirements for control functions as outlined in Clauses 9.2 through 9.14 shall be verified via one or more of the following methods:</p> <p>a) compliance with functional test(s) per Clause 19.7 for each applicable control function; or</p> <p>b) evaluation of the control function and potential hazards to relevant functional safety document.</p>
12	Info	<b>Conductors and cables</b>
12.1	Info	<b>General</b>
		<b><i>New clause added;</i></b>
12.1.6		Conductors and cables used in the overall assembly of machinery shall be subject to the applicable wiring methods and practices in Clause 13.
12.3	Info	<b>Insulation</b>
		Conductors in an assembly intended for use within an enclosure shall be insulated for the highest voltage level normally expected in the conductors except where
12.3.4		<p>a) the wires are grouped to segregate different voltage levels; or</p> <p>b) circuit wires normally operating at lower voltages will not extend beyond the enclosure.</p>
12.4	Info	<b>Flexing applications</b>
12.4.1		Conductors and cables used for flexing applications shall be specifically designed and intended for their application. <u>Flexible conductors and cables shall be suitable for the intended use and one of the types as listed in Table 17 or shall be identified by the manufacturer for use in continuous flexing or torsion applications.</u>



CLAUSE	VERDICT	COMMENT
		<b><i>New clause added;</i></b>
12.4.4		The continuous current carried by flexible cables shall not exceed the values given in Table 17 or the maximum continuous current declared by the manufacturer.
		<b><i>New clause added;</i></b>
12.4.5		Where a flexible cable is comprised of more than three current-carrying conductors, derating correction factors shall be selected in accordance with Table 18.
		<b><i>New clause added;</i></b>
12.4.6		All supply conductors and terminals shall be rated for a minimum 125% of full load.  Note: Full load is calculated with all motors and loads operating at the same time.
		<b><i>New clause added;</i></b>
12.4.7		The edges of an opening through which flexible cable passes, including the opening in a strain relief or bushing, shall be smooth and free from burrs, fins, projections, sharp edges, and the like that could result in abrasion of the insulation of the flexible cable.
		<b><i>New clause added;</i></b>
12.4.8		Where humidity, water, liquids, oil, grease, oily vapour, or other substances are expected to be present, any bushing provided shall be investigated to ensure it is acceptable for use in the intended application(s).
		<b><i>New clause added;</i></b>
12.5		Cables installed in continuous flexing or torsion applications shall be guided to prevent snagging, tangling, or hooking. Cable guides may include internal separations to facilitate the appropriate grouping of cables and other conduits (e.g., pneumatic or hydraulic hoses) used to supply or control the moving machine component. Cable guides can include flexible cable carriers or flexible conduit.  Flexible cable guides shall be suitable for the application. Where humidity, water, liquids, oil, grease, oily vapour, or other substances are expected to be present, flexible cable guides shall be acceptable for use in the intended application.
13	Info	<b>Wiring methods</b>
13.1	Info	<b>General</b>
		<b><i>New clause added;</i></b>
13.1.1		Conductors and cables, as covered by Clause 12, shall be subjected to the applicable wiring practices and methods in Clause 12.2 through 13.9 when used in the assembly of industry machinery.





CLAUSE	VERDICT	COMMENT
		<p><b><i>New clause added;</i></b></p> <p>Equipment mounted on a skid shall meet the following requirements:</p> <ul style="list-style-type: none"><li>a) Skid-mounted equipment that is covered under an existing applicable product standard shall be in accordance with that standard.</li><li>b) Equipment mounted on the skid that is not covered by an applicable product standard shall be further evaluated.</li><li>c) Interconnections between equipment mounted on the skid shall be in accordance with the Canadian Electrical Code, Part I.</li></ul> <p>Note: Evaluation of products to an applicable product standard can be open to interpretation. Since skids are generally intended for use in a specific jurisdiction, the manufacturer is cautioned to work with the pertinent AHJ to ensure the interpretation of the AHJ is properly addressed during such evaluations.</p>
13.3	Info	<p><b>Routing</b></p> <p><b><i>New clause added;</i></b></p>
13.3.5		<p>All bare live parts, including conductors and terminals, shall be secured to their bases or mounting surfaces so that they will be prevented from turning or shifting, which may reduce the spacings. Friction between surfaces shall not be used as a means of preventing the turning of live parts, but a suitable lock washer may be used if properly applied.</p>
13.4		<p><b>Conductor identification</b></p> <p><b><i>New clause added;</i></b></p>
13.4.3		<p>Conductors shall be identified either through the colour of their insulation, acceptable markings for multi-conductor cables, or by installation of a permanent marking such as number markers or heat shrink. The following identifying colours shall be used:</p> <ul style="list-style-type: none"><li>a) green or green with one or more yellow stripes for bonding conductors;</li><li>b) white to identify the grounded circuit conductors or neutrals; and</li><li>c) orange to identify ungrounded circuit conductors that remain energized when the main supply circuit disconnecting means is in the off position.</li></ul> <p>These colours shall be used for no other purposes.</p>
13.4.4		<p><b><i>New clause added;</i></b></p> <p>Other common conductor identifications may include:</p> <ul style="list-style-type: none"><li>a) black for ac or dc power circuits;</li><li>b) red for ac control circuits; and</li><li>c) blue for dc control circuits.</li></ul>



CLAUSE	VERDICT	COMMENT
		<b><i>New clause added;</i></b>
13.4.5		Where a conductor with the required thermal or chemical properties is not available with the appropriate coloured insulation, then notwithstanding Clause 13.4.3a different colour may be used but must be permanently identified with the appropriate colour.
13.6	Info	<b>Wiring outside enclosures</b>
		Flexible cables or connectors may be used to interconnect individual portions of the equipment forming a set or system. The cables or connectors shall
13.6.4		a) not become a shock hazard as a result of the exposure of energized parts when any cable connector is withdrawn from its receptacle; b) be arranged, by terminal configuration or other means, so as to minimize the possibility of an unintentional connection that could be hazardous; c) have a first-make, last-break bonding connection where intended to be disconnected while energized; <u>d) not become a shock hazard as a result of the exposure of energized parts when any flexible cables or cable connector is withdrawn from its receptacle; and</u> <u>e) be arranged, by terminal configuration or other means, to minimize the possibility of an unintentional connection that could be hazardous.</u>
17	Info	<b>Marking and warnings</b>
		<b><i>New section added;</i></b>
17.5		<b>Wiring terminals markings</b>
		See standard for details.
18	Info	<b>Technical documentation</b>
		The information package provided with the machine shall include:
18.3		a) a main document comprising a parts list or list of documents; <u>b) a risk assessment prepared in accordance with CSA Z432, CSA Z434, or other applicable standards; and</u> c) specific documentation including <u>xii) environmental limitations (e.g., lighting, vibration, EMC environment, atmospheric contaminants), where appropriate; and</u> <u>xiii) precautions to be taken for the installation of the electrical equipment relevant to the electromagnetic compatibility.</u>



CLAUSE	VERDICT	COMMENT
19	Info	<b>Type testing and verification</b>
19.1	Info	<b>General</b>  The test requirements shall always include Items a), b), and c), and may include d) through m) as required:  a) impedance test (see Clause 19.2); b) insulation resistance test (see Clause 19.3); c) dielectric strength test (see Clause 19.4); d) residual voltage protection test (see Clause 19.5); e) leakage current test (see Clause 19.6); f) functional test (see Clause 19.7); g) <u>battery overcharge test (see Clause 19.8);</u> h) <u>battery discharge test (see Clause 19.9);</u> i) <u>breakdown of components test (see Clause 19.10);</u> j) <u>strain relief test (see Clause 19.11);</u> k) <u>flexing test (see Clause 19.12);</u> l) <u>stability test (see Clause 19.13); and</u> m) <u>securement of wheels and casters test (see Clause 19.14).</u>
19.2	Info	<b>Impedance test</b>  <b><i>New clause added;</i></b>
19.2.1		Every grounding and bonding circuit on the machine shall be tested either  a) in accordance with Clause 19.2.2 through 19.2.5; or b) in accordance with Clause 19.2.6.
19.2.4		<b><i>New clause added;</i></b>  The resistance between the bonding terminal (see Clause 5.2.11 and Figure 3) and relevant points that are part of the protective bonding circuit shall be measured with a current between at least 0.2 A and approximately 10 A derived from an electrically separated supply source having a maximum no-load voltage of 24 V ac or dc. The resistance measured shall be 0.1 $\Omega$ or less.  Note: Larger currents used for the continuity test increase the accuracy of the test result, especially with low resistance values (i.e., larger cross-sectional areas, lower conductor lengths, or both).
19.2.6		<b><i>New clause added;</i></b>  As an alternative test to that specified in Clause 19.2.2 through 19.2.5, the resistance between the bonding terminal and relevant points that are part of the protective bonding circuit shall be in accordance with the requirements for Continuity of the Equipment Grounding (Protective Bonding) Circuit in NFPA 79 or the requirement in Test 1 – Verification of Continuity of the Protective Bonding Circuit in IEC 60204.



CLAUSE	VERDICT	COMMENT
		<b><i>New section added;</i></b>
19.8		<b>Battery overcharge test</b>  See standard for details.
		<b><i>New clause added;</i></b>
19.9		<b>Battery discharge test</b>  When required by Clause 5.7, the short-circuiting of components (e.g., microprocessor memory devices or semiconductors connected to the terminals of a fully charged battery one at a time) shall not result in any of the unacceptable conditions described in Clause 19.8.2.
		<b><i>New section added;</i></b>
19.10		<b>Breakdown of components test</b>  See standard for details.
		<b><i>New clause added;</i></b>
19.11		<b>Strain relief test</b>  For each combination of cord and bushing, the cord shall be manually pushed into the equipment as far as possible. It shall then be subjected 25 times to a steady pull of the value shown in Table 25 applied for 1 s each time in the least favorable direction.  Immediately afterwards, it shall be subjected for 1 min to a torque of the value shown in Table 25. The torque shall be applied as close as possible to the external end of the cord anchorage or bushing.  Following the completion of the test, there shall be no damage to the cable conductors, insulation, terminals, or associated hardware, or displacement of the cable.
		<b><i>New section added;</i></b>
19.12		<b>Flexing test</b>  See standard for details.



CLAUSE	VERDICT	COMMENT
		<b><i>New clause added;</i></b>
		<b>Stability test</b>
19.13		The stability of an industrial machine not intended to be anchored shall be such that it will not overturn when placed in any position on a surface inclined 10° from the horizontal. During this test, an application having casters shall have the casters turned to the most unfavorable position, and any doors, drawers, or containers supplied with the appliance shall be in the most unfavorable position, whichever is the more severe condition.
		<b><i>New clause added;</i></b>
		<b>Securement of wheels and casters test</b>
19.14		When a wheel or caster is used, it shall be capable of withstanding a pull of 22 N applied by a weight or a steady pull for 60 s in any direction made possible by the construction. At the conclusion of the test, the wheel or caster shall not be damaged or pulled free from its securing means.
		<b><i>New table added;</i></b>
Table 25		<b>Values for strain relief test on cord anchorages</b>
		See standard for details.
		<b><i>New table added;</i></b>
Table 26		<b>Generic materials for the direct support of uninsulated live parts</b>
		See standard for details.
		<b><i>New table added;</i></b>
Table 27		<b>Minimum values for internal insulating materials</b>
		See standard for details.
		<b><i>New figure added;</i></b>
Figure 3		<b>Examples of bonding used on machines</b>
		See standard for details.
		<b><i>New figure added;</i></b>
Figure 4		<b>Arc flash warning</b>
		See standard for details.



CLAUSE	VERDICT	COMMENT
		<i>New annex added;</i>
Annex D		<b>Additional requirements for industrial robots and industrial robotic equipment</b>  See standard for details.
		<i>New annex added;</i>
Annex E		<b>Electromagnetic compatibility (EMC)</b>  See standard for details.