

How Close Can Workers Be To Exposed Energized Electrical Equipment and Conductors?



WHAT'S AT STAKE

Workers are at risk of shock and arc flash burn injuries if they or the equipment they're using comes too close to high voltage energized electrical equipment or conductors. As an employer, you're responsible for ensuring that the minimum clearance distance is maintained at all times. However, minimum clearance distances and rules vary by jurisdiction based not only on voltage but on whether the worker is a qualified person, i.e., one who's qualified to work on or near exposed electrical equipment and thus approach it more closely than a nonqualified worker. Here are the requirements and minimum clearance distances in each jurisdiction.

FEDERAL

Worker must maintain following distances from live electrical equipment that's not guarded or insulated or where worker isn't insulated from ground depending on whether the worker is a qualified worker:

Distances from Live Electrical Parts

| Column I Voltage Range of Part: Part to Ground | Column II Distance in Meters (Nonqualified Person) | Column III Distance in Meters (Qualified Person) |
|---|--|--|
| Over 425 to 12,000 | 3 | 0.9 |
| Over 12,000 to 22,000 | 3 | 1.2 |
| Over 22,000 to 50,000 | 3 | 1.5 |
| Over 50,000 to 90,000 | 4.5 | 1.8 |
| Over 90,000 to 120,000 | 4.5 | 2.1 |
| Over 120,000 to 150,000 | 6 | 2.7 |
| Over 150,000 to 250,000 | 6 | 3.3 |
| Over 250,000 to 300,000 | 7.5 | 3.9 |

| | | |
|-------------------------|-----|-----|
| Over 300,000 to 350,000 | 7.5 | 4.5 |
| Over 350,000 to 400,000 | 9 | 5.4 |

(Canada OHS Regs, Sec. 8.5(6))

ALBERTA

a) Employer must provide safeguards if a worker may accidentally, or through the work process, come into contact with energized electrical cables. If an effective safeguard can't be provided in the circumstances, employer must ensure that an alternative mechanism or system or a change in work procedure is put into place to protect workers (*OHS Code*, Secs. 310(2)(d) and (4)); b) Employer must ensure persons and equipment maintain the following minimum distances from overhead powerlines:

| Operating voltage between conductors of overhead power line | Safe limit of approach distance for persons and equipment |
|--|---|
| 0 ' 750 Volts Insulated or polyethylene covered conductors ⁽¹⁾ | 300 mm |
| 0 ' 750 Volts Bare, uninsulated | 1 metre |
| Above 750 Volts Insulated conductors ^{(1) (2)} | 1 metre |
| 750 volts ' 40 kiloVolts | 3 metres |
| 69 kiloVolts, 72 kiloVolts | 3.5 metres |
| 138 kiloVolts, 144 kiloVolts | 4 metres |
| 230 kiloVolts, 260 kiloVolts | 5 metres |
| 500 kiloVolts | 7 metres |

Notes:

(1) Applies to conductors that are insulated or covered throughout their entire length

(2) Conductors must be manufactured to rated and tested insulation levels

(OHS Code, Sec. 225)

BRITISH COLUMBIA

The following distances must be maintained from exposed electrical equipment and conductors:

| Column I Voltage Phase to Phase | Minimum approach distance for working close to exposed electrical equipment or conductors | Column 2 |
|---------------------------------------|---|----------|
| | Meters | Feet |
| 750 V to 75 kV | 3 | 10 |
| 75 kV to 250 kV | 4.5 | 15 |
| 250 kV to 550 kV | 6 | 20 |

(OHS Regs, Sec. 19.24.1)

The following distances must be maintained when passing under exposed electrical equipment and conductors:

| Column 1 Voltage Phase to Phase | Column 2 Minimum approach distance for passing under exposed electrical equipment or conductors | |
|---------------------------------------|--|------|
| | Meters | Feet |
| 750 V to 75 kV | 2 | 6.5 |
| 75 kV to 250 kV | 3 | 10 |
| 250 kV to 550 kV | 4 | 13 |

(OHS Regs, Sec. 19.24.2)

The following adjusted limits of approach apply to qualified workers:

| Column 1 Voltage Phase to Phase | Column 2 Minimum distance | |
|---------------------------------------|------------------------------|------|
| | Meters | Feet |
| 750 V to 20 kV | 0.9 | 3 |
| 20 kV to 30 kV | 1.2 | 4 |
| 30 kV to 75 kV | 1.5 | 5 |

(OHS Regs, Sec. 19.27)

MANITOBA

a) Employer and owner must ensure that energized electrical equipment is suitably located and guarded so that it's not contacted by a worker; (b) Employer must ensure that work near exposed, energized electrical equipment is done in a manner that prevents a worker from contacting the equipment (*WSH Regs*, Secs. 38.6 and 38.7)

NEW BRUNSWICK

a) Where it's not practicable to de-energize electrical equipment before working on or near energized exposed parts of the equipment, worker must use rubber gloves, mats, shields and other protective equipment to ensure protection from electrical shocks and burns while performing the work (*OHS Regs*, Sec. 287.4); b) Employer must ensure that worker who's not a qualified person maintains following minimum distances from energized electrical utility line or utility line equipment:

| Phase to Phase Voltage of Energized Electrical Utility Line or Utility Line Equipment | Distance |
|---|-----------------|
| Up to 750 Volts | 900 mm (3 feet) |
| 750 Volts to 100,000 Volts | 3.6 m (12 feet) |
| 100,001 Volts to 250,000 Volts | 5.2 m (17 feet) |
| 250,001 Volts to 345,000 Volts | 6.1 m (20 feet) |

(OHS General Reg, Sec. 289(1))

NEWFOUNDLAND

a) Where uninsulated energized parts of **low voltage** equipment aren't guarded with approved cabinets or enclosures, a suitable barrier or cover must be provided where a worker unfamiliar with the hazards is working within the limited approach boundary of 1.07 metres of the uninsulated, energized parts (*OHS Regs*, Sec. 486); (b) Employer must ensure that following minimum distances

is maintained between exposed, energized **high voltage** electrical equipment and conductors and a worker, work, tool, machine, equipment or material:

| Phase to Phase | Minimum Distance |
|-----------------------|------------------|
| Over 750 V to 75 kV | 3 m |
| Over 75 kV to 250 kV | 4.5 m |
| Over 250 kV to 550 kV | 6 m |

(OHS Regs, Sec. 498(3))

NORTHWEST TERRITORIES & NUNAVUT

Employer must ensure the following minimum distances are maintained from exposed energized high voltage electrical conductors:

| Risk Factor | | Column 1 | Column 2 | Column 3 | Column 4 | Column 5 | Column 6 |
|------------------------|-------------------|---|------------------------------|--------------------|---|--|--|
| Voltage Phase to Phase | Voltage to Ground | Non-electrical Workers, Material, Equipment | Qualified Electrical Workers | Vehicles and Loads | Limit of approach for utility tree trimmers using conducting objects exposed to energized parts | Limit of approach for utility tree trimmers using rated tools exposed to energized parts | Limit of approach for utility tree trimmers using rated insulating booms |
| kV | kV | Metres | Metres | Metres | Metres | Metres | Metres |
| 230 | 133 | 6.1 | 1.4 | 1.83 | 2.4 | 1.41 | 1.85 |
| 138 | 79.8 | 4.6 | 1 | 1.22 | 1.9 | 0.92 | 1.35 |
| 72 | 41.6 | 4.6 | 0.6 | 0.8 | 1.6 | 0.61 | 1.05 |
| 25 | 14.4 | 3 | 0.3 | 0.6 | 1.2 | 0.12 | 0.55 |
| 15 | 8.6 | 3 | 0.3 | 0.6 | 1.1 | 0.12 | 0.55 |
| 4.16 | 2.4 | 3 | 0.15 | 0.6 | 1.05 | 0.04 | 0.50 |
| 0.75 | 0.75 | 3 | 0.15 | 0.6 | 1.05 | 0.04 | 0.05 |

(OHS Regs, Sec. 460)

NOVA SCOTIA

Employer must ensure that following minimum distances is maintained between overhead energized power line or power line equipment:

| Phase to Phase Voltage | Minimum Distance |
|------------------------|------------------|
| 750 V to 69,000 V | 3 m |
| 69,001 V to 138,000 V | 5 m |
| Over 138,000 V | 6 m |

(OHS Regs, Sec. 126(4))

ONTARIO

a) If it's not practical to disconnect electrical installations, equipment or conductors from power supply before working on, or near, live exposed parts of the installations, equipment or conductors, the worker shall use rubber gloves, mats, shields and other protective equipment and procedures to ensure protection from electrical shock and burns; and b) Work on electrical transmission systems or outdoor distribution systems of over 750 volts must be carried out in accordance with 2019 edition of Infrastructure Health and Safety Assoc.'s "Electrical Utility Safety Rules" (*OHS Ind Est Regs*, Secs. 42.1 and 42.2)

PRINCE EDWARD ISLAND

Employer (other than electrical utility) must ensure that worker doesn't carry out any work that's liable to bring any person or apparatus, machine, machine component, material or property within the following distances:

| Phase to Phase Voltage of Energized Electrical Utility Line or Utility Line Equipment | Distance |
|---|------------------|
| Up to 750 Volts | .90 m (3 feet) |
| 751 Volts to 100,000 Volts | 3.60 m (12 feet) |
| 100,001 Volts to 250,000 Volts | 5.20 m (17 feet) |
| 250,001 Volts to 345,000 Volts | 6.10 m (20 feet) |

OHS General Regs, Sec. 36.20)

QUÉBEC

Employer must ensure that no one performs construction work liable to bring any part, load, scaffolding, machine component or person than following minimum distances to an aerial electric line:

| Phase to Phase Voltage | Distance (metres) |
|--------------------------------|-------------------|
| Less than 125,000 Volts | 3 |
| 125,000 Volts to 250,000 Volts | 5 |
| 250,000 Volts to 550,000 Volts | 8 |
| More than 550,000 Volts | 12 |

(Safety Code for Const Ind, Sec. 5.2.1.)

SASKATCHEWAN

Employer or contractor must maintain the following minimum distances between workers, materials, equipment, etc. from energized high voltage electrical conductors:

| Risk Factor | Column 1 | Column 2 | Column 3 | Column 4 | Column 5 | Column 6 |
|-------------|----------|----------|----------|----------|----------|----------|
|-------------|----------|----------|----------|----------|----------|----------|

| Voltage Phase to Phase | Voltage to Ground | Non-electrical Workers, Material, Equipment | Qualified Electrical Workers | Vehicles and Loads | Limit of approach for utility tree trimmers using conducting objects exposed to energized parts | Limit of approach for utility tree trimmers using rated tools exposed to energized parts | Limit of approach for utility tree trimmers using rated insulating booms |
|------------------------|-------------------|---|------------------------------|--------------------|---|--|--|
| kV | kV | Metres | Metres | Metres | Metres | Metres | Metres |
| 230 | 133 | 6.1 | 1.4 | 1.83 | 2.4 | 1.41 | 1.85 |
| 138 | 79.8 | 4.6 | 1 | 1.22 | 1.9 | 0.92 | 1.35 |
| 72 | 41.6 | 4.6 | 0.6 | 0.8 | 1.6 | 0.61 | 1.05 |
| 25 | 14.4 | 3 | 0.3 | 0.6 | 1.2 | 0.12 | 0.55 |
| 15 | 8.6 | 3 | 0.3 | 0.6 | 1.1 | 0.12 | 0.55 |
| 4.16 | 2.4 | 3 | 0.15 | 0.6 | 1.05 | 0.04 | 0.50 |
| 0.75 | 0.75 | 3 | 0.15 | 0.6 | 1.05 | 0.04 | 0.05 |

(OHS Regs, Sec. 465)

YUKON

a) Employer must maintain the following minimum distances between workers and equipment and high voltage energized equipment and conductors:

| Phase to Phase Voltage | Limit of Approach Distance |
|---|----------------------------|
| Up to 750 V | 1.0 m (3 feet) |
| 750 V to 40 kV | 3.0 m (10 feet) |
| 69 kV, 72 kV | 3.5 m (12 feet) |
| 138 kV, to 144 kV | 4.0 m (13 feet) |
| 230 kV, 260 kV | 5.0 m (16 feet) |
| 500 kV (or where voltage can't be determined) | 7.0 m (23 feet) |

b) The following adjusted limits of approach allowed for an electrical worker who has taken a course of instruction approved by the director if: i. the high voltage electrical equipment is energized to a potential of no more than 75 kV; ii. a professional engineer determines that rerouting, de-energizing or guarding of the equipment isn't practicable for type of work being done; iii. performed; iv. the work isn't being done for the owner of the power system; v. the work is of a type that's done regularly; and worker follows written safe work procedures developed and implemented under the supervision of a professional engineer:

| Phase to Phase Voltage | Limit of Approach Distance |
|------------------------|----------------------------|
| 600 V (DC) | 0.8 m (31.5 inches) |
| 600 V to 4.60 kV | 0.8 m (31.5 inches) |
| 13.8 kV | 0.85 m (35 inches) |

| | |
|-------------|---------------------|
| 25 kV | 0.95 m (37 inches) |
| 34.5 kV | 1.05 m (41 inches) |
| 69, 72 kV | 1.35 m (53 inches) |
| 138, 144 kV | 1.65 m (65 inches) |
| 230, 260 kV | 2.15 m (85 inches) |
| 500 kV | 3.45 m (136 inches) |

(OHS Regs, Sec. 9.20)

and c) The following limits allowed only for an electrical worker with journeyman qualification, provided worker is authorized by owner of the power system and uses written safe work procedures developed by competent person:

Adjusted Limit of Approach for Qualified Electrical Journeyman Workers

| Phase to Phase Voltage | Limit of Approach Distance |
|-------------------------------|-----------------------------------|
| 600 V (DC) | 0.5 m (20 inches) |
| 600 V to 4.60 kV | 0.5 m (20 inches) |
| 13.8 kV | 0.55 m (22 inches) |
| 25 kV | 0.65 m (26 inches) |
| 34.5 kV | 0.75 m (30 inches) |
| 69, 72 kV | 1.05 m (41 inches) |
| 138, 144 kV | 1.35 m (53 inches) |
| 230, 260 kV | 1.85 m (73 inches) |
| 500 kV | 3.15 m (124 inches) |

(OHS Regs, Sec. 9.21)

BEYOND COMPLIANCE: CSA Z462Yzy

Keep in mind that OHS rules are minimum requirements and that it may be advisable to implement voluntary standards that go beyond the OHS regulations to protect your workers. This is particularly the case with electrical hazards like shock and arc flash. CSA Z462, which is quickly becoming the leading standard for electrical safety in Canada, requires having a “qualified person” carry out a hazard assessment before work on or near exposed energized equipment is carried out to determine:

Shock Boundaries: There are 2 boundaries to protect against shock:

- A limited approach boundary that only a qualified person or an unqualified person who’s accompanied by a qualified person can cross; and
- A restricted approach boundary which requires PPE and protective clothing and equipment to cross.

Shock Protection Boundaries for AC Systems

| Nominal System Voltage Range, Phase to Phase | Limited Approach Boundary(1) | | Restricted Approach Boundary(2) |
|---|-------------------------------------|-----------------------------------|--|
| | Exposed Movable Conductor | Exposed Fixed Circuit Part | |
| Less than 50V | Not specified | Not specified | Not specified |
| 50V to 150V | 3 m (10 ft) | 1 m (3.5 ft) | Avoid contact |

| | | | |
|------------------|---------------------|---------------------|----------------------|
| 151V to 750V | 3 m (10 ft) | 1 m (3.5 ft) | 0.3 m (1 ft) |
| 751V to 15kV | 3 m (10 ft) | 1.5 m (5 ft) | 0.7 m (2 ft, 2 in) |
| 15.1kV to 36kV | 3 m (10 ft) | 1.8 m (6 ft) | 0.8 m (2 ft, 7 in) |
| 36.1kV to 46kV | 3 m (10 ft) | 2.5 m (8 ft) | 0.8 m (2 ft, 9 in) |
| 46.1kV to 72.5kV | 3 m (10 ft) | 2.5 m (8 ft) | 1 m (3 ft, 3 in) |
| 72.6kV to 121kV | 3.3 m (10 ft, 8 in) | 2.5 m (8 ft) | 1 m (3 ft, 4 in) |
| 138kV to 145kV | 3.4 m (11 ft) | 3 m (10 ft) | 1.3 m (3 ft, 10 in) |
| 161kV to 169kV | 3.6 m (11 ft, 8 in) | 3.6 m (11 ft, 8 in) | 1.3 m (4 ft, 3 in) |
| 230kV to 242kV | 4 m (13 ft) | 4 m (13 ft) | 1.7 m (5 ft, 8 in) |
| 500kV to 550kV | 5.8 m (19 ft) | 5.8 m (19 ft) | 3.6 m (11 ft, 10 in) |
| 765kV to 800kV | 7.2 m (23 ft, 9 in) | 7.2 m (23 ft, 9 in) | 4.9 m (15 ft, 11 in) |

Arc Flash Boundary: The arc flash boundary is the minimum “safe” distance from exposed energized conductors or circuit parts with the potential for an arc flash at which the incident energy equals 5 Joules/cm²(1.2 calories/cm²). The arc flash boundary is designed to prevent second degree burns and can be longer or shorter than the limited approach shock boundary.