

OVERVIEW

TITLE: Minimum clearance

Part 19, Electrical Safety
Section 19.24, Minimum clearance

1. WHAT IS THE NATURE OF THE PROBLEM TO BE SOLVED?

Section 19.24 and Table 19-1 in the Occupational Health and Safety Regulation (“OHSR”) prescribes the minimum distance that must be maintained between exposed, energized high voltage electrical equipment and conductors and any worker, tool, machine, equipment or material, except as otherwise permitted by Part 19 of the OHSR. The application of this provision to vehicles or equipment passing under an overhead high voltage power transmission line has become an issue. BC Hydro is the largest owner of such transmission lines in BC and has approached WorkSafeBC requesting clarification on how section 19.24 is to be applied to transmission lines crossing industrial or resource roads.

Power system owners design overhead transmission and distribution lines so the height of the conductors above grade or ground level, including above road surfaces, conform to *CSA Standard C22.3 No. 1-06 Overhead Systems*. This is the nationally recognized industry standard for the minimum clearance to provide for public safety. Application of this standard works well for public roads where there are regulations that establish maximum legal load heights. Vehicles and equipment that conform to the legal load height are considered to be safe from any electrical hazard when travelling on the road under powerlines that are installed at least at the height prescribed in *CSA Standard C22.3*.

On industrial or resource roads, the overall vehicle load heights or equipment heights is often greater than permitted on public roads. Clearance to overhead powerlines is less well controlled and regularly results in the top of the load on a vehicle passing under overhead high voltage power lines coming within the limits of approach specified in section 19.24. WorkSafeBC has been asked what provisions should apply in such cases. For example, a recent inquiry to WorkSafeBC concerned loaded log trucks passing under a 230 kV overhead powerline that crossed the haul road. In this case the loaded log trucks had overall heights up to 24 feet. The vertical clearance to the powerline above the road surface was designed by the owner of the powerline to be 29 feet, in conformance with *CSA Standard C22.3* for “standard” truck maximum legal load height. For compliance with section 19.24, the height of the powerline would need to be 39 feet above the road surface. The road owner, the road user and the owner of the powerline were

trying to determine what clearance was needed and who should pay for any adjustments needed to ensure that clearance was maintained. (Similar concerns will arise for “over height loads” on public roads, even when operating with an “over height” permit from the road owner.)

2. WHAT IS THE PURPOSE OF THIS INITIATIVE?

To clarify the application of section 19.24 to a vehicle or other piece of mobile equipment that is being driven or moved under overhead powerlines with no other work being done by, on or from the vehicle or equipment. It is proposed to add a new provision that will provide alternative minimum clearances for vehicles travelling on industrial or resource roads.

3. SOURCE OF REQUEST

BC Hydro
Numerous logging companies
WorkSafeBC Worker and Employer Services Division (Regulatory Practices, Regional Services)
WorkSafeBC Investigations Division (Engineering)

PART 19: ELECTRICAL SAFETY

Definitions 19.1 In this Part:

"exposed",

as applied to electrical equipment or conductors, means that the conductor or a part of the equipment is

- (a) electrically connected to a source of voltage difference or electrically charged to have a voltage different from that of earth,
- (b) not guarded or insulated in an approved manner, and
- (c) in a location where a person or any tool, equipment or material the person is touching or using might come closer than a safe distance away from the conductor or part;

"mobile equipment"

has the same meaning as in Part 16;

WORKING CLOSE TO ENERGIZED HIGH VOLTAGE ELECTRICAL EQUIPMENT AND CONDUCTORS

**Minimum clearance
Informing
workers about
high voltage
electrical
equipment
and
conductors**

19.24

- (1) The employer must ensure that at least the minimum applicable distance specified in Table 19-1 is maintained between exposed, energized high voltage electrical equipment and conductors and any worker, work, tool, machine, equipment or material, unless otherwise permitted by this Part.
- (2) The employer must accurately determine the voltage of any energized electrical equipment or conductor and the minimum distance from it required by subsection (1).

Before a worker does any work close to high voltage electrical equipment or conductors that are exposed or that might become exposed during work at a workplace, an employer must ensure that the worker is informed of

- (a) the existence, location and voltage of the high voltage electrical equipment and conductors, and
- (b) the work arrangements and procedures to be followed to ensure compliance with this Part.

**Minimum
approach
distance
when working
close to
exposed
electrical
equipment
and
conductors**

19.24.1

Subject to section 19.24.2, or unless otherwise permitted by this Part, if exposed electrical equipment or conductors at a workplace have a voltage within a range set out in column 1 of Table 19-1A, the following must remain at least the distance from the exposed electrical equipment and conductors that is set out in column 2 opposite that range of voltage:

- (a) a worker at the workplace;
- (b) a tool, machine, material, structure or equipment at the workplace.

Table 19-1
Table 19-1A

Column 1 Voltage	Column 2 Minimum distance Minimum approach distance for working close to exposed electrical equipment or conductors	
	Metres	Feet
Phase to phase		
Over 750 V to 75 kV	3	10
Over 75 kV to 250 kV	4.5	15
Over 250 kV to 550 kV	6	20

Minimum clearance distance when driving under exposed electrical equipment and conductors

19.24.2

- (1) This section applies in the circumstance where a worker is driving mobile equipment under exposed electrical equipment or conductors at a workplace and is not performing any work other than driving the mobile equipment.
- (2) Unless otherwise permitted by this Part, in the circumstances set out in subsection (1), if exposed electrical equipment or conductors have a voltage within a range set out in column 1 of Table 19-1B, the following must maintain at least the clearance distance from the exposed electrical equipment and conductors that is set out in column 2 opposite that range of voltage:
- (a) the worker who is driving the mobile equipment;
 - (b) the mobile equipment that the worker referred to in paragraph (a) is driving;
 - (c) the load carried by the mobile equipment referred to in paragraph (b).

Table 19-1B

Column 1 Voltage	Column 2 Minimum clearance distance for driving under exposed electrical equipment or conductors	
	Metres	Feet
Phase to phase		
Over 750 V to 75 kV	2	6.5
Over 75 kV to 250 kV	3	10
Over 250 kV to 550 kV	4	13

PROPOSED AMENDMENTS FOR PART 19: ELECTRICAL SAFETY
IN THE OCCUPATIONAL HEALTH AND SAFETY REGULATION

Assurance in writing 19.25 (1) If the minimum distance in ~~Table 19-1~~ **Table 19-1A** cannot be maintained because of the circumstances of work or the inadvertent movement of persons or equipment, an assurance in writing on a form acceptable to the Board and signed by a representative of the owner of the power system, must be obtained.

Assurance not practicable 19.26 (1) If exposed high voltage electrical equipment and conductors cannot be isolated, rerouted or guarded, work must not be done within the minimum distance in ~~Table 19-1~~ **Table 19-1A** until approval is obtained from the Board and the following precautions are taken:

- (a) the area within which equipment or materials are to be moved must be barricaded and supervised to restrict entry only to those workers necessarily engaged in the work;
- (b) a safety watcher must be designated;
- (c) a positive means must be provided for the safety watcher to give a clear, understandable stop signal to workers in the area, and the watcher must give the stop signal by no other means.

Authorization by owner 19.29 Qualified workers and workers under their direct supervision may work within the minimum distances to energized high voltage electrical equipment and conductors, as specified in ~~Table 19-1~~ **Table 19-1A** and Table 19-2, when authorized by the owner of the power system and using work procedures acceptable to the Board.

TREE PRUNING AND FALLING NEAR ENERGIZED CONDUCTORS

Preliminary inspection 19.30 (1) Before commencing tree pruning or falling close to energized high voltage overhead conductors, the worksite must be inspected by a qualified person, authorized by the owner of the power system, to identify any hazardous areas, including situations where any part of a tree to be pruned or felled is within the applicable minimum distance from an energized conductor as specified in ~~Table 19-1~~ **Table 19-1A**, or may fall within that distance.

Qualifications 19.32 Tree pruning or falling within the minimum distances in ~~Table 19-1~~ **Table 19-1A** from overhead energized high voltage conductors must be carried out by a worker authorized by the owner of the power system to do such work.

Site crew requirements 19.33 Tree pruning or falling is not permitted within the minimum distances in ~~Table 19-1~~ **Table 19-1A** from overhead high voltage energized conductors, unless

- (a) a certified utility arborist or a qualified electrical worker is present at the site and directing the work, and
- (b) at least one additional qualified person, trained in appropriate emergency rescue procedures, is present.

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IN THE OCCUPATIONAL HEALTH AND SAFETY REGULATION**

Explanatory Note:

It is proposed to add to section 19.1 of the Occupational Health and Safety Regulation (“OHSR”) definitions for “exposed” and “mobile equipment” to provide clarity for these terms as used in Part 19 of the OHSR. The definition proposed for “exposed” is similar to the definition for this term provided and used in the Canadian Electrical Code and other CSA Standards.

“Exposed” means the parts of electrical equipment or conductors that are energized or current-carrying can be inadvertently touched or approached nearer than a safe distance. Electrical equipment and conductors are normally energized through connection to a source of voltage such as the “electric grid”, a generator, or a battery. A source of voltage could also be a charged capacitor that is part of the electrical equipment.

Energized parts of electrical equipment and conductors within reach of people in the normal course of activity are generally guarded against inadvertent contact by approved enclosures such as cover plates, cabinets and conduits installed in conformance with the applicable provisions of the electrical code and enabling bylaws. Where conductors are not enclosed in a wall or conduit, the conductors are required to be enclosed in an insulating covering, which is the case for the cords for portable electric tools and appliances and for extension cords. High voltage electrical equipment might also be guarded by placing the equipment in secure compounds (fenced and gated), such as for an electrical system substation. For electrical equipment and conductors that are suitably guarded or insulated, tools or vandalism would be needed to get inadvertent access to the energized parts, or to expose them.

Energized electrical equipment and conductors that are part of a high voltage transmission or distribution system are considered to be safe (not exposed) when placed appropriately out of reach of people going about their normal day-to-day activities. For example, such systems commonly support conductors and transformers up on towers or utility poles so they cannot be approached closer than a safe distance by people during normal day to day activity. If work activities will not cause workers or the tools, equipment or materials the workers are handling or using to “reach up” closer than a safe distance towards the overhead high voltage equipment or conductors, such equipment and conductors can be considered not to be exposed, and the employer need take no further action. However, if a worker will undertake activities requiring elevation above normal walking surfaces, the safe distance provided by putting the energized equipment and conductors up in the air through use of towers or utility poles is compromised, and the employer must ensure the limits of approach stipulated in Part 19 are maintained. Such work may involve a worker going “upwards” directly through use of access equipment such as a ladder, scaffold, or an elevating work platform, or indirectly through use of reach equipment with components that are raised to do a task, such as a lift truck, excavator, crane or boom truck, or concrete placing boom. In addition, if a worker’s “reach” is extended overhead or laterally through the use of tools or when manually handling materials, the limits of approach in Part 19 must be maintained for such tools and materials.

Section 19.24 and Table 19-1 in the OHSR set out the minimum distance that must be maintained between exposed, energized high voltage electrical equipment and conductors and any worker, tool, machine, equipment or material. A number of exceptions are permitted by other sections in Part 19 of the OHSR that are applicable to workers with special training and following work procedures acceptable to the Board. The application of section 19.24 to circumstances where vehicles and mobile equipment are being driven along haul roads or across workplaces and move under overhead high voltage transmission lines has become an issue.

Power system owners design overhead transmission and distribution lines so the height of the conductors above grade or ground level, including above road surfaces, conform to *CSA Standard C22.3 No. 1-06 Overhead Systems*. This is the nationally recognized industry standard for the minimum clearance to provide for public safety (including worker safety). Application of this standard works well for public roads where there are regulations that establish maximum legal load heights. Vehicles and mobile equipment that conform to the legal load height are considered to be safe from electrical hazard from the power system when travelling on the road and crossing under overhead powerlines (conductors) that are installed at least at the height prescribed in *CSA Standard C22.3*. In

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these circumstances the separation between the top of the vehicle or its load and the conductors will conform to the current Table 19-1.

On an industrial site or on resource roads, the maximum vehicle load height or the height of mobile equipment is often greater than permitted on public roads. Clearance between such equipment and overhead high voltage powerlines is less well controlled and can result in the top of a load or a part of the mobile equipment coming within the limits of approach specified in section 19.24 and Table 19-1 when the equipment is travelling along the road. WorkSafeBC has been asked what provisions should apply in such cases. For example, a recent inquiry to WorkSafeBC concerned loaded log trucks passing under a 230 kV overhead electrical transmission line that crossed the haul road. In this case the loaded log trucks had load heights of up to 24 feet. The minimum vertical clearance to the transmission line conductors above the road surface was designed by the owner of the line to be 29 feet, in conformance with *CSA Standard C22.3* for the “standard” maximum legal load height for a vehicle on a public road. For compliance with section 19.24 and Table 19-1, the height of the transmission line would need to be 39 feet above the road surface. The road owner, the road user and the owner of the transmission line were trying to determine what clearance was needed, and who should pay for any adjustments needed to ensure that clearance was maintained.

The minimum clearances required by section 19.24 and Table 19-1 are intended to protect workers undertaking work activities in proximity to exposed, energized high voltage electrical equipment and conductors. The clearances specified keep workers well clear of the electrical hazard area and allow for inadvertent or unintended minor movement by the worker, or tools or materials the worker is handling, towards the electrical equipment and conductors (into the electrical hazard zone.) However, when a vehicle or mobile equipment is just being driven along a road, the driver and any other person riding in the cab of the equipment is generally not likely to change the height of the vehicle or equipment, or its load, that will result in an unexpected movement of the equipment or load closer to the overhead powerlines than the safe zone provided by the planned separation between the conductors and the highest point of the vehicle or equipment, or the load. Thus it is proposed the clearances specified in section 19.24 and Table 19-1 can be reduced and still provide for adequate safety when a worker is “just driving” a vehicle or mobile equipment.

It is proposed to amend section 19.24 to accommodate reduced clearance for mobile equipment passing under overhead electrical equipment and conductors. Proposed new section 19.24 will set out the general obligation for the employer to determine if high voltage electrical equipment or conductors are present in the workplace, and if so, if any of the equipment or conductors are exposed, or might become exposed to workers as work progresses. If so, the employer must ensure workers are informed of the hazard and of the work arrangements and procedures to be followed to do the work safely and in compliance with Part 19.

Proposed new section 19.24.1 will set out the minimum distance that must be maintained between workers, tools, equipment and materials and any exposed (which by definition is energized) high voltage electrical equipment and conductors when work is taking place close to such electrical equipment or conductors. Such activity has generally been referred to as “working in proximity”. The amendment proposes to use the phrasing “working close to”.

Proposed new section 19.24.1 is essentially the existing section 19.24(1) and establishes the general limit of approach and applies unless proposed section 19.24.2 or one of the exceptions in other sections in Part 19 permits otherwise. The exceptions in other sections in Part 19 allow different and closer limits of approach for qualified electrical workers or specially trained workers following appropriate safe work procedures acceptable to the Board.

Proposed new section 19.24.2(1) proposes an exception to section 19.24.1 when a vehicle or mobile equipment is being driven under an overhead powerline, provided the worker driving the vehicle or mobile equipment is not doing any work other than driving the vehicle or mobile equipment. The proposed exception, set out in new section 19.24.2(2), provides that the minimum clearance between any part of the vehicle or mobile equipment, or its load, and the exposed high voltage electrical equipment and conductors overhead may be reduced to the limits in proposed new Table 19-1B, unless the exceptions in other sections in Part 19 apply. Once again, these other exceptions are the

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closer limits of approach allowed for qualified electrical workers or specially trained workers following appropriate safe work procedures acceptable to the Board.

The minimum clearance distances proposed for Table 19-1B are based on consideration of the applicable standards published by the Institute of Electrical and Electronics Engineers and recommendations from two of the major electrical utility companies in BC.

Proposed section 19.24.2 will generally apply to vehicles hauling oversize loads on industrial sites or along haul roads. For example, "off-highway" log hauling trucks generally have loads higher than trucks hauling on public roads, and the employer or prime contractor will need to know and control the maximum load height for such "off-highway" log trucks as necessary to ensure the clearance specified in Table 19-1B is maintained. Similarly, when equipment such a log loader or feller/buncher is being driven from one work location to another, the employer will need to ensure the height of the equipment in the configuration being used when driving or travelling the equipment will allow it to pass under any overhead high voltage conductors by at least the clearance specified in Table 19-1B.

The height of heaped loads on earth or rock hauling trucks also needs to be known and controlled to ensure the top of such loads can pass under any overhead conductors by at least the clearance specified in Table 19-1B. When a truck box is raised to dump or spread material, the driver is doing more than just driving the vehicle and the minimum approach distances in Table 19-1A apply.

It is expected that road maintenance vehicles, such as road graders and trucks rigged up for snow plowing, salting/sanding or dust suppression operations will have overall heights that ensure clearance to the limits in Table 19-1A during grading, plowing or salting/sanding/spraying operations. A worker grading a surface, or plowing snow, salting/sanding or spraying water or other road treatment on a surface is considered to be doing more than "just driving" the vehicle or equipment.

The proposed amendments to section 19.24 would result in Table 19-1 being renamed as Table 19-1A. Sections 19.25(1), 19.26(1), 19.29, 19.30(1), 19.32, and 19.33 of the OHSR reference Table 19-1. It is proposed that these sections would be amended to reference Table 19-1A.