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REVISIONS: UPDATED LEGAL ACKNOWLEDGEMENT FORM. FD MAR '16

DESIGNED J. AGNOLIN	RECOMMENDED  F. DENNERT	ACCEPTED  G. REIMER	ENGINEER OF RECORD 	NOTICE FROM THE EXECUTIVE VICE PRESIDENT TRANSMISSION AND DISTRIBUTION AND CUSTOMER SERVICE		
DISTRIBUTION STANDARDS 		ISSUED: MAR 2016 REPLACES: MAY 2004 ORIGINALLY ISSUED: NOV 1980				PAGE 1 OF 2

Scope

This manual is one of a series containing standards for construction of the BC Hydro electrical distribution plant within the service area of BC Hydro. A new distribution plant shall be designed, constructed, owned, operated, maintained and repaired to these standards.

Purpose of Standards

BC Hydro objectives require standardization to:

- Ensure uniform safety requirements comply with BC statutes and regulations.
- Provide uniform system reliability.
- Provide uniform operating practices.
- Permit economic bulk purchasing of materials.
- Achieve optimum life cycle cost of plant construction.
- Effect efficient quality assurance.

Responsibility

The Distribution Standards Department prepares these standards and verifies that specified plant and procedures will perform adequately under all normally expected conditions encountered throughout the province of British Columbia. These standards are approved by Professional Engineers. It is the responsibility of BC Hydro Managers to ensure that the standards are followed unless abnormal conditions are encountered that require variations. These variations should be kept to a minimum and their performance shall be the responsibility of the Professional of Record in charge of the project, who will record and seal the variation based on satisfactory qualifications and experience to do so. As per the latest revision of the BC Hydro Distribution Owner's Engineer Guide, these variations must be accepted by BC Hydro's Owner's Engineer.

Use of Stock Materials

The electrical distribution plant covered by these standards is built using stock materials approved by a Professional Engineer as required by law. The use of non-stock materials for special and unusual situations must be approved by Distribution Standards or the BC Hydro Engineer responsible for the project.

Revisions to Manual




These standards are revised from time to time to improve the safety, performance, workability, cost effectiveness or appearance of the plant. The existing plant built to previous standards need not be updated unless so specifically advised by BC Hydro. When maintenance or other work, such as voltage conversion or conductor change is being done, updating plant to current standards is encouraged.

Mailing Addresses

The manual has been issued to a corporation or firm rather than to an individual. The corporation or firm is responsible for the safekeeping of the manual, and for keeping it current. Changes of address or in number of copies required must be reported promptly.

Suggestions for changes in the manual, or required changes of address may be made on the pre-addressed comment sheet included in the Manual and with each issue of revision.

REVISIONS: UPDATED LEGAL ACKNOWLEDGEMENT FORM. FD MAR '16

DESIGNED J. AGNOLIN	RECOMMENDED  F. DENNERT	ACCEPTED  S. REIMER	ENGINEER OF RECORD  F. U. DENNERT PROFESSIONAL ENGINEER BRITISH COLUMBIA	NOTICE FROM THE EXECUTIVE VICE PRESIDENT TRANSMISSION AND DISTRIBUTION AND CUSTOMER SERVICE		
DISTRIBUTION STANDARDS BC Hydro		ISSUED: MAR 2016 REPLACES: MAY 2004 ORIGINALLY ISSUED: NOV 1980		PAGE 2 OF 2	ES43/53/54/55/65 A1-01.02	R 4

R. 1- REDONE & REVISED. MAY'01 BF R. 2- REVISED & TITLE BLOCK CHANGE. MAY'10 FK

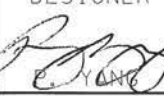


SECTION B - CLEARANCES

ES43 B1

CLEARANCES: GENERAL NOTES

B1-01	Clearances - General Notes
B1-02	Standard Vertical Sag Criteria for Wires and Conductors above Ground and Roads
B1-03	Vertical Design Clearances of Wires and Conductors above Ground
B1-11	Clearances above Ground for Low Voltage Services
B1-12	Clearances over Railway Crossings
B1-13	Vertical Spacing of Power Conductors and Communication Lines Attached to the Same Pole
B1-15.01	Minimum Clearances - Buildings and Streetlights
.02	Canadian Electrical Code Clearance Requirements
B1-16	Vertical Separation between Conductors Carried on Separate Supports

CLEARANCES TABLE OF CONTENTS

DESIGNER  P. YANG	RECOMMENDED  C. PICASSI	APPROVED  F. BENNERT
ORIGINAL ISSUE DATE: OCTOBER 1985		

BChydro  DISTRIBUTION STANDARDS

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ES43 B0-01

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1. Mandatory Minimum Clearances:

The following pages give the mandatory minimum clearances, separations, and spacing that must be maintained between electric power conductors, communication lines, span guys, foreign objects, and the ground under specified conditions. To ensure that these minimum values are met under maximum specified loading and service conditions, additional day-to-day clearance must be obtained to allow for varying operating, weather, and other conditions on or around the pole. Allowances should also be made for anticipated future changes such as distribution or communication plant additions, changes to road grades, new buildings adjacent to the pole line, etc.

2. Vertical Clearances:

Vertical clearances shown are, in general, those specified in CSA Standard C22.3 No. 1-10, and apply under conditions of maximum specified design sag due to either ice-loading or thermal expansion, whichever is larger. Vertical clearances apply to any point of the span, so allowances must be made for the profile of the terrain. To calculate the clearance of inclined spans, see ES43 Y1-04.

3. Horizontal Clearances:

Horizontal clearances shown are, in general, those specified in CSA Standard C22.3 No. 1-10, and apply under conditions of maximum specified design swing for the conductor or wire. To calculate conductor swing, see ES43 Y1-06.

4. Private Property:

For conductors over private property, clearances must conform with the requirements of the Canadian Electrical Code (CSA Standard C22.1, Canadian Electrical Code Part 1).


5. Highways:

For conductors crossing or alongside highways, clearances shown are those specified in the B.C. Ministry of Transportation & Infrastructure (MoTI) Utility Policy Manual, and apply within MoTI rights-of-way.

6. Navigable Waters:

Clearances over navigable waters are not included in this section. Such clearances are subject to the regulations of Transport Canada and are shown on the individual crossing permits.

DRAFTER: DM

DESIGNER  P. YANG	RECOMMENDED  C. PICASSI	APPROVED  F. DENNERT
ORIGINAL ISSUE DATE: SEPTEMBER 1985		

CLEARANCES GENERAL NOTES

BChydro  **DISTRIBUTION STANDARDS**

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7. Gas / Propane Tanks:

Conductors are not to pass over gasoline pumps or propane tanks over 7600 litres capacity. Primary conductors, including the system neutral, are to be kept 7.6 m horizontal distance from gasoline pumps or propane tanks.

8. Secondary Conductors:

The practical clearance of secondary and neutral conductors may be dictated by pole attachment heights needed to attain required service clearances (see ES43 B1-11).

9. Joint Use Poles:

On joint use poles, minimum clearances and attachment heights of conductors are dictated by Provincial and National Regulations, by the BC Hydro/TELUS Joint Use Agreement, and by variations established from time-to-time by the Joint Use Coordinating Committee (JUCC). (See ES43 C2-01).

10. Over-Height Vehicle Clearances:

For line construction through farmland, consideration must be given to the likelihood of large farm machinery being moved about. Near machinery depots, dumping areas, and logging areas, additional vertical clearances may be required by local agreement to allow passage of vehicles and machinery in excess of 4.15 m in height. Where combined height of vehicle plus load exceeds 4.15 m, clearances must be increased by the amount by which the height exceeds 4.15 m. (See ES43 B1-03)

11. Transmission Line Clearances:

Transmission Engineering must be consulted for clearances to transmission conductors, as sags may change significantly under extreme operating conditions (see ES43 B1-16).

12. Horizontal Separation from Other Buried Services:

Minimum separation of 0.6 m is required between the edge of the base of a pole and the nearest face of other buried service, in order to permit pole replacement without damage to other services.

DESIGNER

RECOMMENDED

APPROVED



P. YANG



C. PICASSI



F. DENNERT

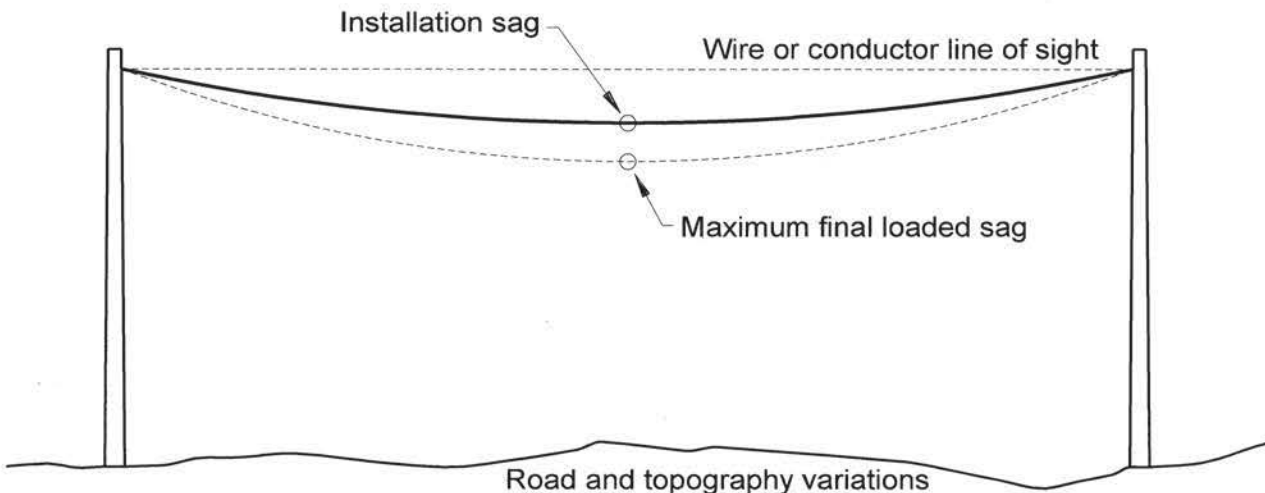
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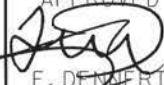


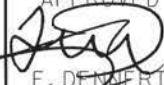


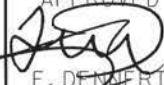

NOTES:

1. Minimum wire and conductor clearances above ground and roads are mandated by road authorities and CSA Standards. Minimum vertical clearances are based on maximum final design sag conditions.
2. For service placing heights see ES43 B1-11.
3. For clearances over railway crossings see ES43 B1-12.

ES43 F2-02
ES43 F1-04
ES43 F1-01

REFERENCE DRAWINGS

DRAFTER: DM	DESIGNER	RECOMMENDED	APPROVED	STANDARD VERTICAL SAG CRITERIA FOR WIRES AND CONDUCTORS ABOVE GROUND AND ROADS		
	C. YANG	C. PICASSI	F. DENNERT			
ORIGINAL ISSUE DATE: NOVEMBER 2012						
BChydro DISTRIBUTION STANDARDS				PAGE 1 OF 1	ES43 B1-02	R. 0

LOCATIONS OF WIRES OR CONDUCTORS	SPAN GUYS, COMMUNICATION WIRES	SYSTEM VOLTAGE								
		0 - 750 V Phase-Gnd	750 V - 22 kV Phase-Gnd							
	Minimum vertical clearances at maximum final design sag									
Over B.C. freeways, expressways and signalized intersections as approved under MoTI jurisdiction	5.5 m	6.1 m	6.7 m							
Over or alongside B.C. MoTI highways. Greater clearance may be required for highway maintenance and construction equipment as determined by the District Highways Manager	5.0 m	6.1 m	6.7 m							
Over roads, streets, lanes, driveways (other than: residential driveways); over the right-of-way of underground pipelines, and land not likely to be travelled by high road vehicles or high farm machinery	4.42 m	4.42 m	4.75 m							
Alongside roads and within 1.5 m of the limit of the right-of-way. (These are generally adjacent to fences and accessible to small vehicles but are not likely to be travelled by high road vehicles or high farm machinery)	3.0 m	3.4 m	4.15 m							
Over walkways or ground normally accessible only to pedestrians, snowmobiles, and personal-use all-terrain vehicles. (Seasonal conditions may require additional clearances)	2.5 m	3.1 m	3.4 m							
<p>NOTES:</p> <ol style="list-style-type: none"> Clearances shown are <u>absolute minimum clearances under maximum final design sag conditions</u>. To ensure these clearances are met, additional clearance is required over and above the normal ambient operating conditions. Add the amount by which vehicle heights are permitted to exceed 4.15 m. For neutral and secondary conductors, maximum sags will occur under ice-loading. For primary conductors, maximum sag may occur under ice-loading or thermal expansion. To calculate clearance of inclined spans, see ES43 Y1-04. 										
<table border="1"> <tr> <td>DESIGNER  P. YANG</td> <td>RECOMMENDED  C. PICASSI</td> <td>APPROVED  F. DEMERT</td> <td rowspan="2"> VERTICAL DESIGN CLEARANCES OF WIRES AND CONDUCTORS ABOVE GROUND </td> </tr> <tr> <td colspan="3">ORIGINAL ISSUE DATE: SEPTEMBER 1985</td> </tr> </table>				DESIGNER  P. YANG	RECOMMENDED  C. PICASSI	APPROVED  F. DEMERT	VERTICAL DESIGN CLEARANCES OF WIRES AND CONDUCTORS ABOVE GROUND	ORIGINAL ISSUE DATE: SEPTEMBER 1985		
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ORIGINAL ISSUE DATE: SEPTEMBER 1985										
BChydro  DISTRIBUTION STANDARDS		PAGE 1 OF 1	ES43 B1-03							
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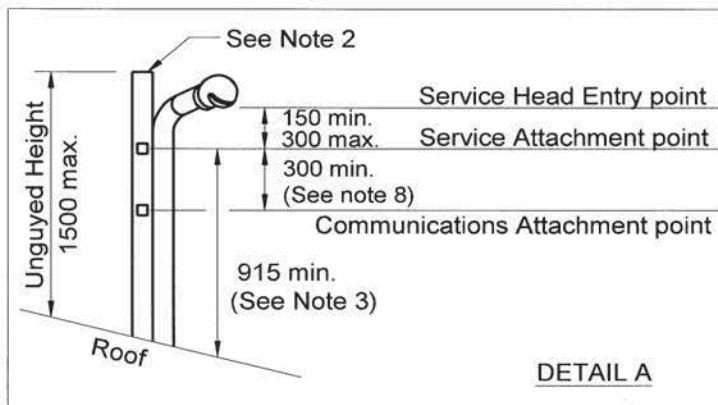
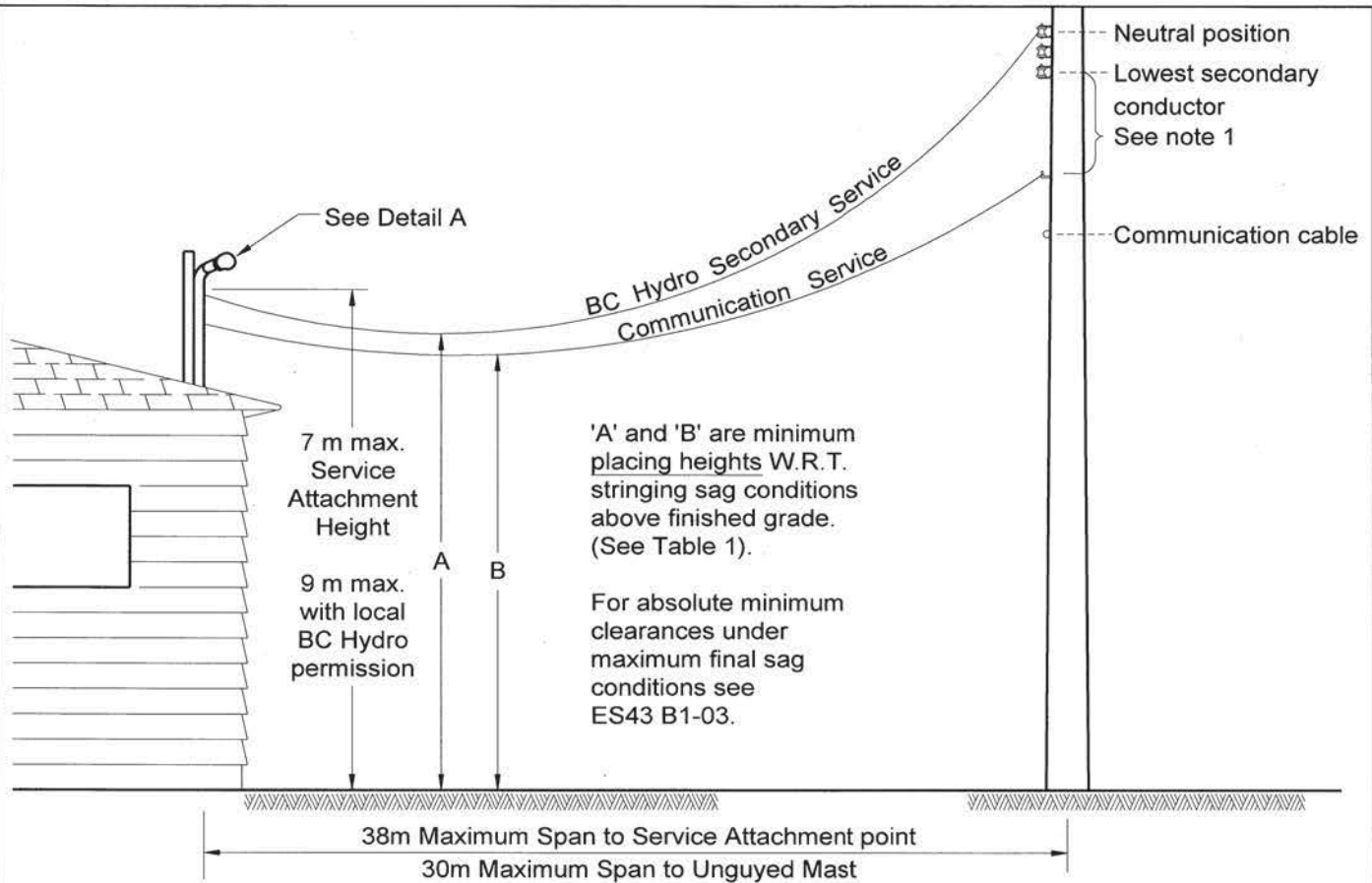


TABLE 1

LOCATION	A (Hydro)	B (TELUS)
Across MoTI Freeways, Expressways	7.1 m	6.4 m
Across MoTI Highways	7.1 m	5.9 m
Across Streets, Lanes, Pipeline Row	5.5 m	5.3 m
Across Residential Driveways	4.5 m	4.3 m
Across Commercial and Industrial Driveways	5.5 m	5.3 m
Across Ground only Accessible to Pedestrians	3.5 m	3.0 m

NOTES:

- For Joint Use spacing on Pole see ES43 C2-01.
- Mast and Service Head to comply with clause 6-112 and 6-116 of the Canadian Electrical Code, Part 1, 2009.
- Drip Loop clearance to roof 600 mm minimum.
- Services must also meet the requirements of Distribution Instruction S10-2.
- All clearances shown apply to services attached directly to the side of buildings. See ES43 N2-02, N2-05 and N2-06.
- On Joint Poles ensure that sufficient clearance is available to allow for communication service placing height.
- All dimensions in mm except where noted.
- Telus requires 600 mm separation on commercial buildings.

R.3- TITLE BLOCK, NOTES REVISED, MAR'10 FK

DRAFTER: DM

DESIGNER	RECOMMENDED	APPROVED
R. YANG	C. PICASSI	F. DENNERT

ORIGINAL ISSUE DATE: SEPTEMBER 1985

**CLEARANCES ABOVE GROUND
FOR LOW VOLTAGE SERVICES**

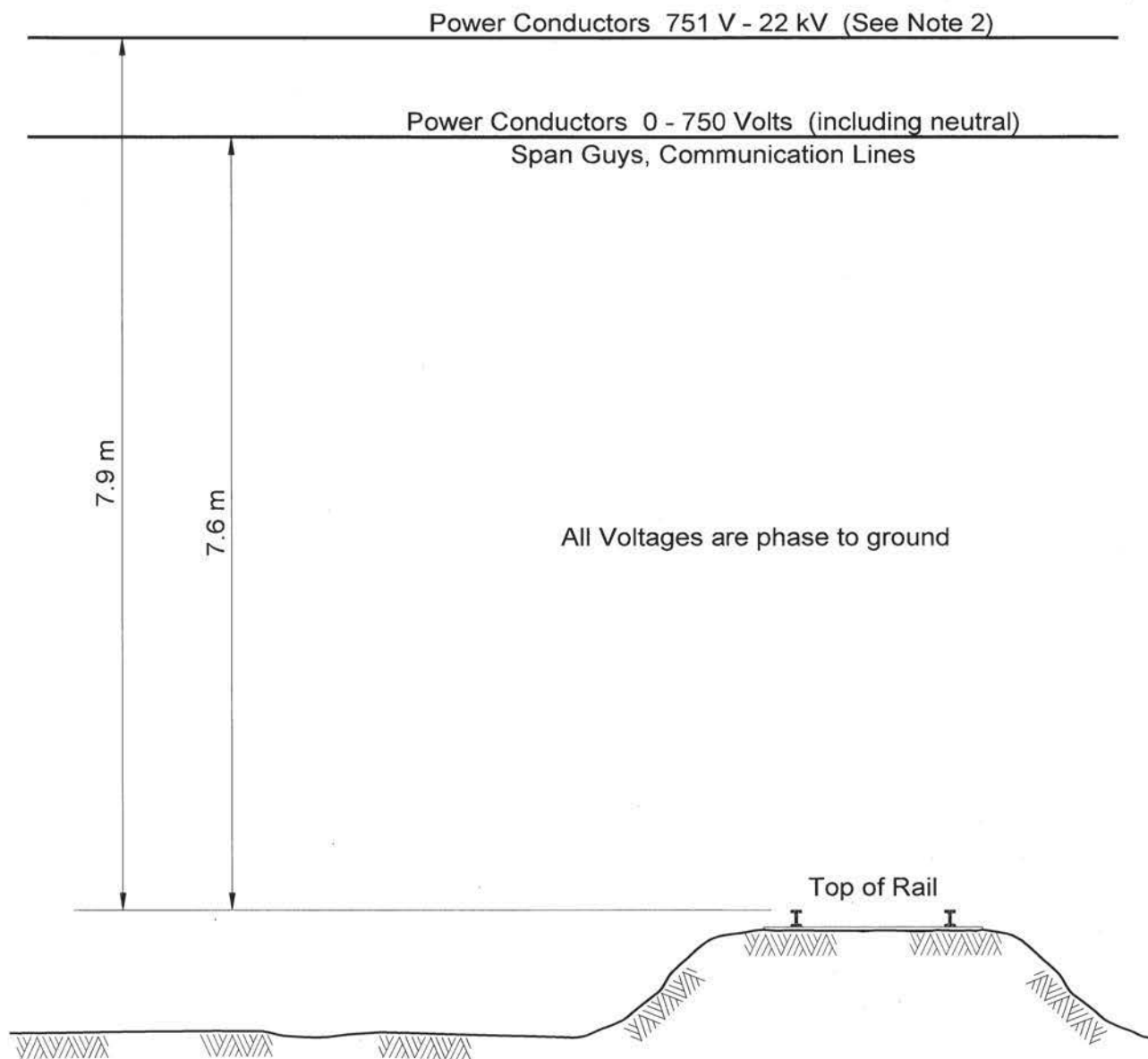
BC Hydro **DISTRIBUTION STANDARDS**

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ES43 B1-11



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R, 3- TITLE BLOCK, CSA C22.3 NO.1-10, MAR.'10 FK
DRAFTER: DM



NOTES:

1. Clearances shown are absolute minimum under any and all conditions of sag and loading as specified in CSA C22.3, No.1-10.
2. Clearances include 0.3 m allowance for future ballast lift.
3. Clearances are measured from the top of the rail to the sag point directly over the rail.
4. Transmission Engineering must be consulted for clearances to transmission conductors, as sags may change significantly under extreme operating conditions.

DESIGNER  R. YANG	RECOMMENDED  C. PICASSI	APPROVED  F. DEHNERT
ORIGINAL ISSUE DATE: SEPTEMBER 1985		

**CLEARANCES
OVER RAILWAY CROSSINGS**

Vertical Separation Between Power Conductors and Communication Lines Attached to Same Pole

ES43 B1-13

Application

This standard provides the vertical separation required between conductors and communication lines attached to the same pole.

Revision Notes

Added *Application*, *Revision Notes*, and *References* sections. Edited Table 1 column headings for clarity, to more closely match CSA 22.3 Table 23. Deleted “with WP covering” and changed 2 mm to 75 mm in note 4a. Added note 5. Added reference to ES43 C2-02 to note 6. Changed content is marked by green vertical revision lines in the left margin. This revision released concurrently with Standards and Equipment Advisory Information Bulletin 2023-037 *Revised ES43 B1-13 Distance Between Supply and Communication Conductors*.

References

BC Hydro Distribution Standards

ES43 C2-01	Spacing and Separation Wire Spacing on Joint Use Pole Below the Neutral
ES43 C2-02	Spacing and Separation In-Span Separation Between Secondary/Neutral Conductors and Communication Wires
ES43 G3-10	Single-Phase Flat Tangent
ES43 G3-11	Single-Phase Flat Angle 5° - 45°
ES43 G3-12	Single-Phase Flat Dead-End
ES43 G3-13	Single-Phase Flat Double Dead-End

External Documents

CSA 22.3 No.1 Overhead systems

Notes

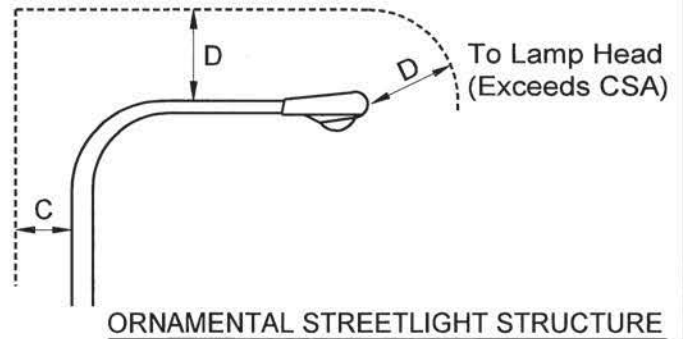
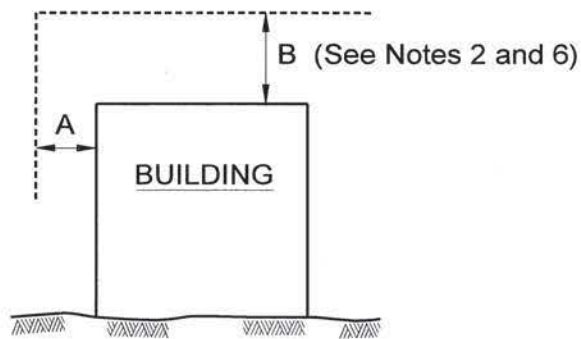
Table 1 – Minimum vertical separation (all voltages are phase to ground)

Between	Minimum vertical separation for power conductor voltages	
	0 V to 750 V	751 V to 22 kV
Power conductors and communication lines at the pole	1.0 m (see note 2)	1.2 m (see note 3)

1. Table 1 spacings at the pole conform with CSA C22.3 No.1, Table 23 *Minimum vertical separations at a joint-use structure*, but may in some cases be less than the framing dimensions shown in the ES43 standards. Standard framing dimensions, if larger, supersede the spacings in Table 1.

Designed: A. Kehoe			Vertical Separation Between Power Conductors and Communication Lines Attached to Same Pole	
Checked: K. Middleton, P. Eng			DISTRIBUTION STANDARDS 	ES43 B1-13 R4
Reviewed: K. Middleton, P. Eng				
Approved: H. Giesbrecht, P. Eng				
		Issued: 2023-11-07 Effective: 2023-11-07		

2. Separation for communication service drops at the pole may be reduced to 0.6 m (see ES43 C2-01).
3. A multi-grounded neutral is considered to be 0 to 750 volts. See ES43 G3-10, 11, 12, and 13 for single-phase flat construction communication spacing.
4. Per CSA C22.3 No.1, Table 24 *Minimum in-span vertical clearances between supply and communication conductors*, minimum in-span vertical clearances between supply and communications conductors are measured from the line of sight of the highest communication wire or cable as follows:
 - a. 0 V to 750 V: 75 mm
 - b. 751 V to 15 kV: 300 mm
 - c. 15 kV to 22 kV: 380 mm
5. Conductors are considered bare even when covered by weatherproof coverings, as coverings can fail before the end of the conductor's lifespan.
6. The neutral for spans over 75 m may sag below the line-of-sight of the communication attachments, but not lower than 300 mm above the communication line in the span (per ES43 C2-02 and CSA C22.3 No.1, clause 5.10.3.3).






VOLTAGE PHASE TO GROUND	BUILDING SURFACE		SIGNS, BILLBOARDS, LAMP & TRAFFIC STRUCTURES	
	A Horizontal (See Note 3)	B Vertical (See Note 2)	C Horizontal (See Note 3)	D Vertical (See Note 2)
0 - 750 V	1.0 m (See Note 4)	2.5 m	1.0 m	1.0 m
0.75 - 22 kV	2.0 m	3.0 m	3.0 m	3.0 m

NOTES:

- Clearances apply to any part of the building or streetlight standard.
- Vertical clearances for conductors are absolute minimum under maximum design loading conditions. Conductors over 750 volts should not pass over buildings.
- Horizontal clearances for conductors are in addition to maximum conductor design swing.
- Conductor clearance shall be increased to 1.5 m where conductors pass in front of windows or other openings, unless satisfactorily guarded.
- All clearances meet or exceed CSA Standard C22.3 No. 1-10, Table 9 where applicable.
- Where practical, clearances greater than the minimum specified values should be provided for enhanced safety to persons in or on buildings, workers maintaining streetlights, and firefighters.
- Refer to ES43 B1-15.02 for Canadian Electrical Code requirements of supply plant.

R. 3- TITLE BLOCK, CSA C22.3 No. 1-10, PAGE 2 ADDED. MAR. '10 FK

DRAFTER: DM

DESIGNER  P. YANG	RECOMMENDED  C. PICASSI	APPROVED  F. DENNERT
ORIGINAL ISSUE DATE: SEPTEMBER 1985		

MINIMUM CLEARANCES BUILDINGS AND STREETLIGHTS

BCHydro  DISTRIBUTION STANDARDS

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NOTES, cont.

Verbatim Rules from the 2012 Edition of the Canadian Electrical Code, Part 1 are listed below. Compliance with the Code edition adopted in the Province of British Columbia is required.

8. Rule 26-014 Dielectric liquid-filled equipment - Outdoors (see Appendix B)

- (1) Except as permitted by Subrule (3), dielectric liquid-filled electrical equipment containing more than 46 L in one tank, or 137 L in a group of tanks, and installed outdoors shall not be located within 6m of:
 - (a) any combustible surfaces or material on a building
 - (b) any door or window
 - (c) any ventilation inlet or outlet
- (2) The dimension referred to in Subrule (1) shall be the shortest line-of-sight distance from the face of the container containing the liquid to the building or part of the building in question.
- (3) Notwithstanding the requirements of Subrule (1), the equipment shall be permitted to be installed within 6m of any item listed in Subrule (1) (a), (b), and (c), provided that a wall or barrier with non-combustible surfaces or material is constructed between the equipment and that item.
- (4) Where dielectric liquid-filled electrical equipment containing more than 46 L in one tank, or 137 L in a group of tanks, is installed outdoors it shall
 - (a) be inaccessible to unauthorized persons;
 - (b) not obstruct firefighting operations;
 - (c) if installed at ground level, be located on a concrete pad draining away from structures or be in a curbed area filled with coarse crushed stone; and
 - (d) not have open drains for the disposal of the liquid in the proximity of combustible constructions or materials.

9. Rule 12-310 Clearance of conductors

The conductors shall be located or guarded so that they cannot be reached by a person standing on a fire escape, flat roof, or other portion of a building, and they shall be at least 2.5 m above the highest point of a flat roof or roof that can be readily walked upon and at least 1 m above peaked roofs or the highest point of roofs that cannot be readily walked upon, except that where a deviation has been allowed in accordance with Rule 2-030, they shall be permitted to be less than 2.5 m but not less than 2 m above the highest point of a flat roof or roofs that can be readily walked upon.

DRAFTER: DM	DESIGNER	RECOMMENDED	APPROVED	CANADIAN ELECTRICAL CODE CLEARANCE REQUIREMENTS		
	 F. YANG	 C. PICASSI	 F. DENNERT			
	ORIGINAL ISSUE DATE: SEPTEMBER 1985			BChydro  DISTRIBUTION STANDARDS	PAGE 2 OF 2	ES43 B1-15.02

Application

This standard provides the vertical separation required between conductors carried on separate supports.

Revision Notes

Added *Application*, *Revision Notes*, and *References* sections. Updated transmission engineering standard reference in note 4. Added note 6. Changed content is marked by green vertical revision lines in the left margin. This revision released concurrently with Standards and Equipment Advisory Information Bulletin 2023-023 *Revised ES43 B1-14 and ES55 B3-06 Vertical Separation of Conductors on Separate Supports*.

References

Other BC Hydro Documents

ES41 K 1.1 Electrical Clearances for Overhead Transmission Lines

External Documents

CSA 22.3 No.1 Overhead systems

Notes

1. Obtain agreement from Transmission Engineering before distribution lines are designed or constructed, or clearances are altered beneath transmission lines, as sags may change significantly under extreme operating conditions. Obtain transmission line elevations at maximum sag from Transmission Engineering, as normal survey methods will not determine maximum sag conditions.
2. These minimum separations meet or exceed CSA C22.3 No.1, Table 13, and apply when the top conductors are at maximum sag.
3. A multigrounded neutral is less than 750 volts.
4. Minimum separations to conductors above 25 kV meet or exceed ES41 K 1.1, Table 3.
5. Increase clearance to meet the specified clearance in the de-wired position if the trolley pick-up arm is not prevented from de-wiring.
6. Attach BC Hydro and telecommunications plant to a common pole at crossing locations when practicable when installing new or modifying existing telecommunications cable or BC Hydro conductors.







Designed: K. Middleton, P. Eng			Vertical Separation Between Conductors Carried on Separate Supports	
Checked: K. Middleton, P. Eng				
Reviewed: H. Giesbrecht, P. Eng			DISTRIBUTION STANDARDS 	ES43 B1-16 R4
Approved: H. Giesbrecht, P. Eng				
		Issued: 2023-07-07 Effective: 2023-07-07		

Table 1 – Required vertical separation between conductors

Conductors and span guys at lower level (phase to ground)	Conductors at upper level (phase to phase) (m)							
	750 V	25 kV	(see Notes 1 and 4)					
			60 kV	138 kV	230 kV	287 kV	360 kV	500 kV
Communication	0.3	2.1	2.1	2.1	2.6	3.1	3.5	4.2
Span guys	0.2	0.5	1.4	2.0	2.6	3.1	3.5	4.2
0 V to 750 V AC	0.3	0.5	1.4	2.0	2.6	3.1	3.5	4.2
751 V to 22 kV AC	–	0.6	1.4	2.0	2.6	3.1	3.5	4.2
Trolley 0 V to 750 V DC (see Note 5)	0.6	0.9	1.4	2.0	2.6	3.1	3.5	4.2

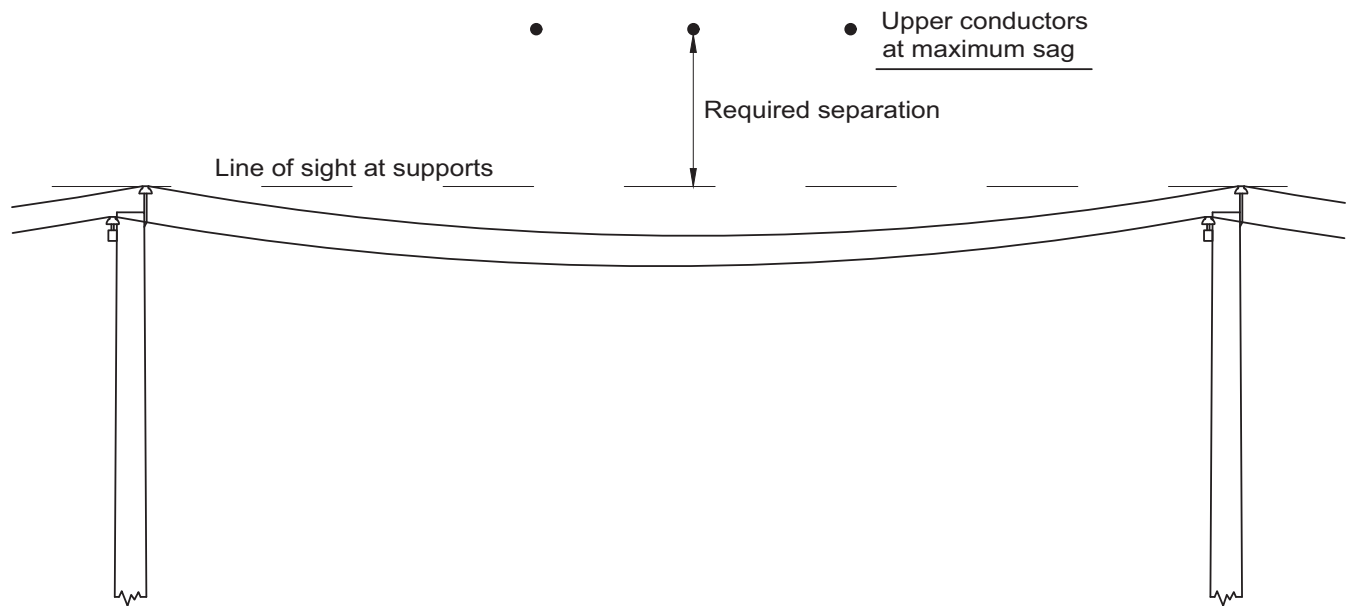


Figure 1 – Vertical separation