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REVISIONS: UPDATED LEGAL ACKNOWLEDGEMENT FORM. FD MAR '16

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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:

- a) Ensure uniform safety requirements comply with BC statutes and regulations.
- b) Provide uniform system reliability.
- c) Provide uniform operating practices.
- d) Permit economic bulk purchasing of materials.
- e) Achieve optimum life cycle cost of plant construction.
- f) 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.

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SCOPE

This section covers overhead secondaries and services. Information on the O/H portion of underground services (dips) is also included. For detailed guidance on U/G services, refer to the Underground Electrical Standards (ES53) and Civil Standards (ES54).

STANDARD SECONDARY VOLTAGES AND CONDUCTORS

The three standard secondary voltages as outlined in DI S10-4 are as follows:

Single Phase 3 Wire 120/240 V Grounded Split Phase
Three Phase 4 Wire 120/208 V Grounded Wye
Three Phase 4 Wire 347/600 V Grounded Wye

All secondary shall be of open wire construction run on clevises spaced 200 mm apart for max. 60 m spans or 250 mm apart for max. 75 m spans (see ES43 N2-01 for details), and shall use polyethylene-covered ACSR for phase conductors (except 266.8 kcm, which is ASC) and bare ACSR for neutrals. The only exception shall be for secondaries run from secondary bus work beneath transformer platforms or on H-frame structures. In this case, both the bus work and secondary may be polyethylene-covered copper conductors (see ES43 N2-08 for details).

WARNING: Poly-covering on the phase conductors carries no guaranteed insulation value and conductors shall be treated as bare. Limits of approach must be maintained.

For size selection of secondary conductors, see ES43 Y1-15. For standard stock secondary and service conductors, see ES43 N1-01.06 Bill of Material.

This section, as well as Section J of this manual, contains wiring and installation standards for three phase - three wire services. These standards are included as reference for maintenance, emergency repairs or extraordinary circumstances only, and shall not be used as standards for new construction.

NEUTRAL CONDUCTOR SIZE AND INSTALLATION

For 1 phase secondaries, the neutral conductor shall always be placed above the phase conductors. For 3 phase secondaries, however, the neutral shall be placed below the phase conductors, so that if 1 phase is added later the neutral shall be between and common to both. If more than one 3 phase voltage is installed on the same pole, the higher 3 phase voltage must always be above the lower 3 phase voltage.

The neutral shall be no smaller than as indicated below:

SIZE OF PRIMARY OR SECONDARY PHASE CONDUCTOR	MINIMUM SIZE OF NEUTRAL CONDUCTOR
#2 and smaller Larger than #2	#2 ACSR 1/0 ACSR

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GENERAL SECONDARY VOLTAGES AND CONDUCTORS NEUTRAL CONDUCTOR SIZES

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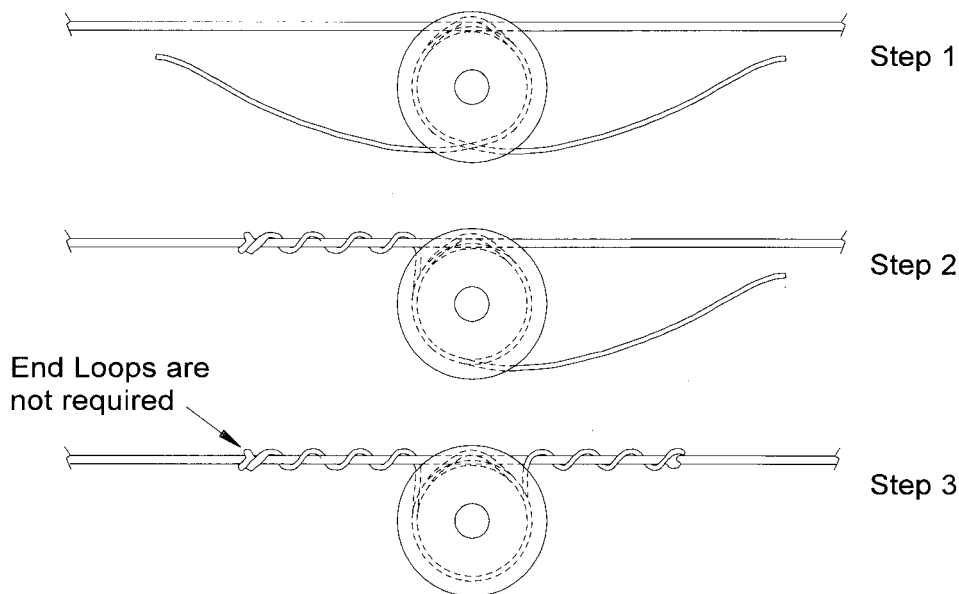
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SECONDARY TIES

Bare neutrals and poly-covered phase conductors are to be tied to the secondary spool insulators with #4 soft drawn bare aluminum (388-4912) for aluminum conductors and with #6 soft drawn copper (380-0061) for copper conductors.



Tie Installation Procedure:

1. Cinch conductor to insulator with loop around insulator, as shown in Step 1 above.
2. Return tie wire to conductor and start wrapping opposite ends in opposite directions, see Step 2.
3. Tie at least five turns on each side, laying the last turn close in, as shown in Step 3 above.

SPLICING OF SECONDARY LINE CONDUCTORS

To splice secondary line conductors, full tension compression splices must be used (see ES43 F5-01). Phase wire connections must be taped (see ES43 F4-01.03). Dead-ending and jumpering through of secondaries at poles is preferable to splicing.

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GENERAL SECONDARY TIES SPLICING SECONDARY CONDUCTORS

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CONNECTIONS TO THE SECONDARY



All connectors described in this section are to be installed in accordance with the requirements and configuration in Section F.

Connections of drop leads and services to secondary conductors may involve combinations of copper to copper, aluminum to aluminum, or copper to aluminum. Section F details the specific connectors to be used in each of these instances, but the following will serve to outline general connector requirements.

Copper to Copper Connections

For connections joining up to maximum 4/0 Cu, a copper compression connector shall be used. Connections above this size are to be made with two-bolt clamps. Note that wedge taps are not to be used on copper to copper connections. See ES43 F5-06 for connector selection.

Copper To Aluminum or Aluminum to Aluminum Connections

These make up the majority of secondary connections and are to be made using aluminum compression connectors. Use the "H-Type" compression connectors shown on ES43 F5-05. Connections involving the #12 copper streetlight luminaire leads to the secondary bus or #4 duplex are to be made using the special aluminum compression connectors shown on ES43 F5-09. For copper to aluminum connections, aluminum conductors must be positioned above copper to prevent corrosion.

CUSTOMER'S SERVICE ENTRANCE REQUIREMENTS

The customer's point of attachment (wire holder) for Hydro's service drop must be installed by the customer and shall conform with the Canadian Electrical Code, and must also be of a type and in a location that is satisfactory to BC Hydro as per Distribution Instruction S10-2. A bolted clevis suitable for tension is recommended in preference to a screw type clevis.

BC Hydro will not connect the customer service if:

1. The required clearances for the service drop cannot be maintained (See ES43 B1-11).
2. Insufficient conductor has been left to make a proper drip loop (200 mm min.).
3. The service support is not suitable to hold the service conductors if the insulator should break.
4. Customer service mast is not exposed or mounted on a running board.
5. Customer-owned pull boxes have been installed without acceptance by local BC Hydro Designer.
6. Customer-owned LB (90°) fittings are not sealable and have been installed without acceptance by BC Hydro Designer.

For service entrance connection details see ES43 N2-02, N2-05, and N2-06.

SERVICE CONDUCTOR CONFIGURATIONS AND SIZE SELECTION

Single phase services should always use triplex conductor, even in situations where two parallel runs may be required.

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GENERAL SECONDARY ENTRANCE CONDUCTOR SIZES AND CONFIGURATIONS

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Three phase services should use quadruplex conductor for loads which can be accommodated by two parallel runs of quadruplex. For larger services, the choice of using multiple quadruplex runs versus an open-wire copper conductor configuration will depend on a careful analysis of the economics and practicality in each specific situation.

For details on service size selection based on main switch size, load, service length and voltage drop, see Section Y.

SERVICE CONDUCTOR CONNECTIONS

Splicing of multiplex ACSR neutrals is accomplished with the bare, reduced-tension compression splices shown on ES43 F5-09.

Splicing of multiplex ASC phase conductors must be done with the pre-insulated splices marked with an asterisk on ES43 F5-07 (note 4).



When splicing multiplex phase conductors, ensure that the pre-insulated connectors are not under tension and that no more than one through splice is installed per service run. Refer to ES43 F6-02 for installation details. At weatherhead, stagger service entrance connectors by minimum one connector length.

Connection of BC Hydro service conductors to the customer's service entrance conductors is to be made as follows:

1. Single Run Multiplex

The connectors shown on ES43 F5-07 are to be used. Note that all phase connectors are the pre-insulated type except when connecting 1/0 and 3/0 multiplex to the customer's 3/0. In this case an aluminum "H-Type" tap connector is used instead. It is imperative that this bare connection be properly taped in accordance with ES43 F4-01.03. Neutrals up to 1/0 (customer's) shall be connected with a bare splice or an "H-Type" connector as specified on ES43 F5-07. (Do not use pre-insulated service entrance connectors on the neutral in this size range). For customer service conductors above 1/0, connect the neutral with the pre-insulated service connectors shown. Neutral connections are not to be tape covered. For multiple weatherhead connection details, see ES43 N2-05.

2. Single Run Copper Open Wire

Copper open-wire services shall be connected to the customer's service entrance conductors in accordance with "Connection to the Secondary" on ES43 N1-01.03. For multiple weatherhead connection details, see ES43 N2-05.

3. Multiple Runs of Multiplex or Open Wire

Multiple (parallel) runs of aluminum multiplex or copper open-wire shall be connected to the customer's service entrance conductors as detailed on ES43 N2-05. For an equal number of BC Hydro and customer service entrance runs, each run shall be connected separately, using pre-insulated service entrance splices for phase conductors and reduced tension compression splices for neutrals. For an unequal number of BC Hydro and customer service entrance runs, the extra run(s) shall be connected using H-Type connectors as shown, to avoid overheating of connectors or portions of conductor.

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GENERAL SERVICE CONDUCTOR CONNECTIONS

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SERVICE CONNECTION AT THE POLE

Service connection at the pole can be made either to a secondary bus or directly to the secondary terminals of a transformer. For service connections to a secondary, refer to ES43 N1-01.03, N2-02, and N2-07. Where service attachment at the pole is impractical or would result in an aerial trespass, use a mid-span tap per ES43 N2-09. For service connection direct to the secondary terminals of a transformer, the following procedure is to be followed:

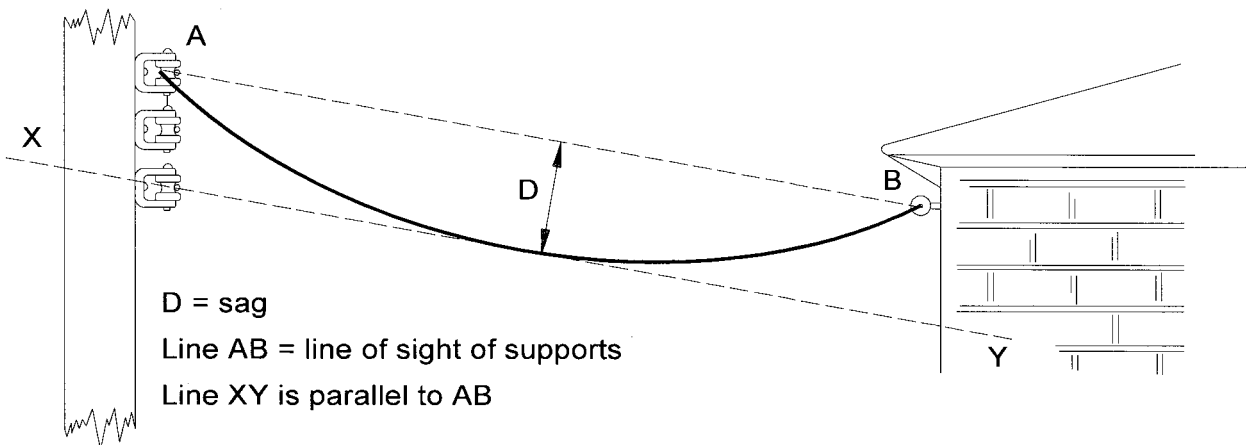
1. On transformers with "basket" (bolted) terminals use compression pin terminals when drop leads are aluminum. For copper drop leads, insert the conductor directly into the transformer connector. See ES43 N2-03, 04, and 07 for details. See ES43 F5-10 for pin terminal selection.
2. On transformers with "spade" (pads) terminals, use two-hole compression lugs for both aluminum and copper drop leads. Refer to ES43 F5-10 and J1-16 for details.

For connection of U/G services (dips) to either O/H secondary or O/H transformers, refer to ES43 N2-07.01 and N2-07.02.

SAGGING OF SERVICE CONDUCTORS

A service drop is almost always an inclined span, dead-ended at both supports. For services longer than 38 m, intermediate poles are required, and the maximum service span to an unguyed service mast is 30 m, per CEC Part 1 and DI S10-2. All services must be sagged in accordance with the sag charts on ES43 F2-25, and must provide the minimum clearances shown on ES43 B1-11. The maximum ice-loaded tension permissible is 2.7 kN (600 lb.).

The sketch below shows a typical service drop. The sag can be determined by measuring the perpendicular distance between the "belly" of the conductor and the line of sight between the two conductor supports.



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SERVICE CONNECTION AT THE POLE
SAGGING OF SERVICES

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NOTES:

1. Where two stock numbers are shown, the first indicates reels, the second coils.
2. #4 Duplex is used only for streetlighting where no secondary exists.
3. These conductors are also used as transformer drop leads.

BILL OF MATERIAL

Item	Description	Catalogue ID
SECONDARY CONDUCTORS		
1	1/0 ACSR, PE covered - see Note 1 3/0 ACSR, PE covered 266.8 ASC, PE covered 2 AWG Cu, MHD, PE covered - see Note 3 2/0 Cu, SD, PE covered - see Note 3 4/0 Cu, SD, PE covered - see Note 3 350 Cu, SD, PE covered - see Note 3 500 Cu, SD, PE covered - see Note 3	382-3044/45 382-3051 382-3083 380-0256 380-0259 380-0261 380-0265 380-0266
NEUTRAL CONDUCTORS		
2	2 AWG ACSR, Bare 1/0 ACSR, Bare	382-2210 382-2213
SERVICE CONDUCTORS		
3	4 AWG Duplex, 4 AWG ACSR Neutral - see Note 2 4 AWG Triplex, 4 AWG ACSR Neutral - see Note 1 2 AWG Triplex, 4 AWG ACSR Neutral - see Note 1 1/0 Triplex, 2 AWG ACSR Neutral - see Note 1 3/0 Triplex, 1/0 ACSR Neutral 266.8 Triplex, 3/0 ACSR Neutral 2 AWG Quad., 2 AWG ACSR Neutral 1/0 Quad., 2 AWG ACSR Neutral 3/0 Quad., 1/0 ACSR Neutral 266.8 Quad., 3/0 ACSR Neutral	382-2100 382-2181/80 382-2186/85 382-2187/88 382-2190 382-2191 382-2192 382-2194 382-2197 382-2198
DI S10-1 to 4 Distribution Instructions ES54 Section S Services ES53 Section S Services ES43 Y1-15 Secondary Conductor Selection Table ES43 N2-08 H-Frame Transformer Platform Secondary Bus ES43 N2-01 Typical Secondary/Neutral Structures ES43 Section F Conductors and Connectors ES43 B1-11 Clearances above Ground for Low Voltage Services REFERENCE DRAWINGS		

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**GENERAL
BILL OF MATERIAL AND NOTES**

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