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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	ES43/53/54/55/65 A1-01.01 ^R 4

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.

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



Information Bulletin:

Revision to ES54 Standards, Sections B, C, F, H, U and Z

1.0 Items Covered

ES54	SECTION B	PULL/SPLICE, SERVICE AND JUNCTION BOXES
	SECTION C	VAULTS
	SECTION F	TRANSFORMER PADS AND VAULTS
	SECTION H	DUCT
	SECTION U	ENGINEERING
	SECTION Z	MATERIAL CATALOGUE

2.0 Overview

The tables below provide detailed summaries of the revisions to ES54 Sections B, C, F, H, U and Z.

2.1 Section B, Pull/Splice, Service and Junction Boxes

Changes to Section B include revised labels for duct entry locations to align with applications outlined in ES53 and text boxes added to individual sections to identify installations that are confined spaces. Additionally a new standard for the 832 bottomless box has been added.

ES54 Standard			Description of Revision
B0-01	Pull/Splice, Service and Junction Boxes, Table of Contents	R7	New standards added: - B3-03 Lightweight Service Box, Small, Sidewalk Duty - B3-04 Lightweight Service Box, Large, Sidewalk Duty - B5-04 832 Box, Pull/Splice/Service/Junction Box - Bottomless
B0-02	Pull/Splice, Service and Junction Boxes, General Notes	R1	- Added paragraph titled 'Lifting and Handling' (page 1), - Added paragraph titled 'Confined and Restricted Access Spaces' (page 1), - Revised minimum number of risers installed

		with Roadway Duty boxes from one 300 mm and one 150 mm to one 150 mm (Finished Grade Change, page 2), • Added lightweight service box (B3-03/B3-04) and Off Roadway Duty to service box load duty and selection matrix (page 3), • Deleted Non Traffic, Sidewalk and Lane Duty options from service boxes with manhole covers in load duty and selection matrices (pages 3,4,5), • Added sentence 'Roadway Duty 332, 632, and 555 boxes with manhole covers' (page 3), • Changed '400 A cable systems ...' to read '600 A cable systems ... ' (Medium Voltage Splice Boxes, page 4) • Added 632 box to medium junction box selection matrix (page 5), and • Added paragraph titled 'Duct Entry Locations' (page 6).	
B2-04	555 Service Box, Roadway Duty	R4	• Deleted 300 mm precast riser, • Deleted lifting holes and bar, • Deleted comment 'Grout all holes after ground conductor installation' (page 1), and • Added text box 'Important: This installation is a confined space' (page 1).
B4-01	1232 Box, Pull/Splice Box, Non-Traffic Duty	R1	• Added second precast concrete riser, • Deleted lifting holes and bars, • Deleted comment 'Grout all holes after ground conductor installation' (page 1), and • Added text box 'Important 1232 box installed with two risers has a depth greater than 4.5 feet (1350 mm) and is a confined space' (page 1).
B4-02	1232 Box, Pull/Splice/Junction Box, Sidewalk Duty	R1	• Added second precast concrete riser, • Deleted lifting holes and bars, • Deleted comment 'Grout all holes after ground conductor installation' (page 1), • Added text box 'Important 1232 box installed with two risers has a depth greater than 4.5 feet (1350 mm) and is a confined space' (page 1), and • Added Note 5 'Unobstructed area may be reduced to 1000 for pull/splice boxes' (page 3).
B5-01	832 Box, Pull/Splice Box, Non-Traffic Duty	R1	• Deleted lifting holes and bars, • Deleted comment 'Grout all holes after ground conductor installation' (page 1), and

			Added text box 'Important: Non-Traffic duty 832 box installed with more than 165 mm of earth cover has depth greater than 4.5 feet (1350 mm) and is a confined space' (page 1).
B5-02	832 Box, Pull/Splice/Junction Box, Sidewalk Duty	R1	- Deleted lifting holes and bars, - Deleted comment 'Grout all holes after ground conductor installation' (page 1), - Revised two road side entries from 'duct entry' to 'alternate duct entry' (page 2), and - Added Note 6 'Unobstructed area may be reduced to 1000 for pull/splice boxes' (page 3).
B5-03	832 Box, Pull/Splice/Junction Box, Access Lane Duty	R1	- Deleted lifting holes and bars, - Added text box 'Important: This installation is a confined space' (page 1), - Revised two road side entries from 'duct entry' to 'alternate duct entry' (page 2), and - Added Note 6 'Unobstructed area may be reduced to 1000 for pull/splice boxes' (page 3).
B5-04	832 Box Pull/Splice/Service/Juncti on Box, Bottomless	R0	New standard
B6-01	632 Box, Pull/Splice Box, Non-Traffic Duty	R1	- Deleted lifting holes and bars, - Deleted comment 'Grout all holes after ground conductor installation' (page 1), - Added text box 'Important: Non-traffic duty 632 box installed with more than 165 mm of earth cover has a depth greater than 4.5 feet (1350 mm) and is a confined space' (page 1), - Deleted duct entries on long walls of box (page 2), and - Revised duct entries on short walls from 'alternate duct entry' to 'duct entry' (page 2).
B6-02	632 Box, Pull/Splice/Service/Juncti on Box, Sidewalk Duty	R1	- Deleted lifting holes and bars, - Deleted comment 'Grout all holes after ground conductor installation' (page 1), - Revised duct entries from 'duct/alternate duct entry' to 'LV/MV service/alternate duct entry' (page 2), and - Added Note 6 'Unobstructed area may be reduced to 1000 for pull/splice boxes' (page 3).
B6-03	632 Box, Service/Junction Box, Access Lane Duty	R1	- Deleted lifting holes and bars, - Deleted comment 'Grout all holes after ground conductor installation' (page 1),

			- Added text box 'Important: This installation is a confined space' (page 1), - Revised duct entries from 'duct/alternate duct entry' to 'LV/MV service/alternate duct entry' (page 2), and - Added Note 6 'Unobstructed area may be reduced to 1000 for pull/splice boxes' (page 3).
B6-04	632 Box, Service Box, Roadway Duty	R1	- Deleted 300 mm precast riser, - Deleted lifting holes and bars, - Deleted comment 'Grout all holes after ground conductor installation' (page 1), - Added text box 'Important: This installation is a confined space' (page 1), and - Added word 'secondary' to all duct entries (page 2).
B7-01	332 Box, Service/Junction Box, Sidewalk Duty	R2	- Deleted lifting holes and bar, - Deleted comment 'Grout all holes after ground conductor installation' (page 1), - Added text box 'Important: There is a Safe Work Procedure in place for this installation' (page 1), - Revised duct entries from 'duct/alternate duct entry' to 'LV/MV service/alternate duct entry' (page 2), and - Added Note 5 'Unobstructed area may be reduced to 1000 for pull/splice boxes' (page 3).
B7-02	332 Box, Service/Junction Box, Access Lane Duty	R2	- Deleted lifting holes and bar, - Deleted comment 'Grout all holes after ground conductor installation' (page 1), - Added text box 'Important: There is a Safe Work Procedure in place for this installation' (page 1), - Revised duct entries from 'duct/alternate duct entry' to 'LV/MV service/alternate duct entry' (page 2), and - Added Note 5 'Unobstructed area may be reduced to 1000 for pull/splice boxes' (page 3).
B7-03	332 Box, Service Box, Roadway Duty	R1	- Deleted 300 mm precast riser, - Deleted lifting holes and bar, - Deleted comment 'Grout all holes after ground conductor installation' (page 1), - Added text box 'Important: There is a Safe Work Procedure in place for this installation' (page 1), and - Added word 'secondary' to all duct entries

(page 2).

2.2 Section C, Vaults

The general notes from Section C were revised to clarify the construction of vault necks using precast concrete risers and burial depth of vaults. The standards for cast-in-place vaults were revised to include duct terminators, grounding inserts and additional reinforcement.

C0-02	Vaults, General Notes	R1	- Added sentence 'Specifically, 25 mm of grout shall be' to second paragraph under 'Installation' (page 2), - Added section through vault neck showing grout detail (page 2), and - Added paragraph titled 'Burial Depth and Finished Grade Adjustments' (page 2).
C2-01	Cast-In-Place Vaults, Through Type, Double Access	R7	- Rebar around manhole opening revised from '4x15M06 (B)' to '4x15M06 (T&B)' (Roof Slab Reinforcement, page 3), - Rebar around sump opening revised from '4x15M10 (T)' to '4x15M10 (T&B)' (Floor Slab Reinforcement, page 6), - Quantity of 15M06 revised from 8 to 16 and quantity of 15M010 revised from 4 to 8 (Rebar Chart, page 7), and - Duct terminator and integral grounding electrode (Items 10 and 11) added to Bill of Material (page 8).
C2-03	Cast-In-Place Vaults, T-Type, Double Access	R7	- Rebar around manhole opening revised from '4x15M05' to '4x15M05 (T&B)' (Roof Slab Reinforcement, page 2), - Rebar around sump opening revised from '4x15M36' to '4x15M36 (T&B)' (Floor Slab Reinforcement, page 3), - Quantity of 15M36 revised from 4 to 8 (Rebar Chart, page 6), and - Duct terminator and integral grounding electrode (Items 10 and 11) added to Bill of Material (page 7).
C2-04	Cast-In-Place Vaults, 4-Way Type, Double Access	R7	- Rebar around manhole opening revised from '4x15M10' to '4x15M10 (T&B)' (Roof Slab Reinforcement, page 2), - Rebar around sump opening revised from '4x15M13 (T)' to '4x15M13 (T&B)' (Floor Slab Reinforcement, page 3), - Quantity of 15M010 revised from 8 to 16 and quantity of 15M013 revised from 4 to 8 (Rebar Chart, page 5), and

		Duct terminator and integral grounding electrode (Items 10 and 11) added to Bill of Material (page 6).
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2.3 Section F, Transformer Pads and Vaults

The standard for single-phase low profile transformer pyramid pads was revised to show an alternate duct entry.

F1-03	Single Phase Low Profile Transformer Pad, Pyramid Pad	R8	Added alternate duct entry to Duct Diagram (page 3).
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2.4 Section H, Ducts

In Section H, several revisions were made to align with the applicable CSA reference standards. FRE conduit was changed to RTRC (Reinforced Thermosetting Resin Conduit) and the specified concrete strength and type of cement were revised. Minimum duct separation for direct buried duct banks were added to Section H2.

H0-01	Duct, Table of Contents	R4	Revised titles of 'Concrete Encasement' standards to include imperial dimensions.
H0-02	Duct, General Notes	R6	- Added titles of CSA standards (Types of Ducts, page 1), - Revised acronym from FRE to RTRC to align with CSA standards, - Added sentence 'For trenchless duct installation see Class of Work....' (Types of Ducts, page 1), - Revised RTRC to PVC transition couplings from e-loc to Champion Fiberglass (page 1), - Deleted BC Hydro catalogue IDs for bends (paragraph 2, PVC to RTRC Duct, page 1), - Added text 'Cat ID 97000676' (Warning Tape and Warning Boards, page 2), - Revised note 2 from 'cable-pulling tension exceeds 5.5 kN' to 'sidewall bearing pressure exceeds 3.3 kN/m' (Concrete Encasement, page 3), - Revised CSA C22.2 reference from No. 211.1 to No. 211.2 (Schedule 40) (Paragraph 2, Concrete Encasement, page 3), - Added text 'Root deflector shall be placed per manufacturer's instruction' and 'Root deflector shall be Polyethylene, minimum 2 mm thick' (Root Deflector, page 3). - Revised concrete strength from 20 MPa to 25 MPa, added reference to CSA A23.1-14 (Concrete material, page 5), - Revised type of cement from Portland

			cement Type 10 to type GU or GUb (Concrete material, page 5), and Deleted Notes and Reference Standards (page 6).
H1-01	General Trenching Details, URD, UD and Feeder Installations	R5	- Added note 5 (page 3), - Deleted paragraphs titled 'Concrete' and 'Construction,' and - Added sentence 'Responsibility for wall penetration' (Wall Penetration, page 3), and - Added reference standards ES54 H2-01, H2-02 and H2-03.
H2-01	Concrete Encasement, 3 Inch (75 mm) Duct	R5	- Revised title to include imperial units, - Revised duct spacing (center to center) from 145 to 135, - Revised excavation depths from 315 and 460 to 300 and 445, and - Added note 2 'Duct separation for 3 inch duct banks'
H2-02	Concrete Encasement, 4 Inch (100 mm) Duct	R5	- Revised title to include imperial units, and - Added note 2 'Minimum duct separation for 4 inch duct banks'
H2-03	Concrete Encasement, 5 Inch (125 mm) Duct	R5	- Revised title to include imperial units, - Revised excavation depths from 405, 595 and 785 to 555, 745 and 935, and - Added note 2 'Concrete-encased 5 inch duct banks ...' (page 1), and - Added note 3 'Minimum duct separation for 5 inch duct banks ...' (page 1).

2.5 Section U, Engineering

Two standards from Section U were revised significantly. First, the design criteria standards were updated to include a new load duty level, Off-Roadway. Second, the standard for bollard installations was updated and a new standard for roadside barriers was created.

U0-01	Engineering, Table of Contents	R4	- Revised title for ES54 U2 from 'Concrete Pads' to 'Concrete Pad Protection,' - Revised title for U2-01 from 'Above-Ground Equipment, General Notes' to 'General Notes', - Revised title for U2-02 from 'Above-Ground Equipment, Mechanical Protection' to 'Bollards,' and - Added new standard U2-03 Roadside Barriers.
U1-02	Design Criteria, Design Loads	R4	Added fifth live load duty (Off Roadways) and sentence 'The load duties with

			corresponding live loads' (Vertical Loads, page 3), - Added Off-Roadway to application duty table (page 3), and - Added section titled 'Hold-down Anchors' (page 6).
U1-03	Design Criteria, Product and Application Test	R1	Revised Load Test Methods and Procedures table (page 2): - Added column 'Test Pad,' - Deleted ANSI Tier 22 from Roadway Duty, - Added ASHTO M306 to Sidewalk Duty, - Added Off Roadway Duty, and - Revised Sidewalk Duty test load from 120 kN to 100 kN.
U2-01	Concrete Pad Protection, General Notes	R2	- Deleted second paragraph 'The installation of blast walls ...', - Revised text from 'or roadway concrete barriers' to 'or MOTI precast concrete barriers as shown in ES54 U2-02', - Deleted fourth paragraph 'The plastic pipe or conduit and cap', - Added paragraph starting with 'Grounding construction standards utilize....' - Reworded and combined fifth and sixth paragraphs, and - Added section titled 'Roadside Precast Barriers.'
U2-02	Concrete Pad Protection, Bollards	R6	- Revised dimension 'b', added dimensions 'c' and 'c/2', added additional bollards, added 'min' to dimensions 'a/2' and 'b/2' (Plan view, page 1), - Revised grounding bar on precast bollards (Front View, page 1), - Precast barriers moved to U2-03 (page 2), - Revised lifting method of precast bollard (page 3), and - Added grounding bar and dimensions to Precast Bollard (page 3).
U2-03	Concrete Pad Protection, Roadside Barriers	R0	New standard (page 1 previously U2-02.02)

2.6 Section Z, Material Catalogue

Several dimensional errors were corrected in Section Z, FRE ducts were changed to RTRC to align with Section H, and polymer concrete service boxes were added.

Z0-01	Material Catalogue, Table of Contents	R3	- Revised title of Z1-06.06 from 'Lightweight Plastic Service Box' to 'Lightweight Service Box, Non-Traffic Duty', and - Added Z1-01.07 'Lightweight Service Box, Sidewalk/Off-Roadway Duty.'
Z1-01	Concrete Products	R6	- Revised title from 'Lightweight Plastic Service Box' to 'Lightweight Service Box, Non-Traffic Duty' (page 6), and - Added page 7 'Lightweight Service Box, Sidewalk/Off-Roadway Duty.'
Z1-02	Precast Concrete Vault	R6	- Revised dimensions of through type double access vault - Height of top section changed from 1480 to 1380, and - Height of bottom section changed from 1360 to 1300 (page 1).
Z1-04	Switchgear Pads, Frames and Vaults	R5	Revised height of bottom section of below ground switchgear precast vault from 1430 to 1450 (page 3).
Z1-05	Transformer Pads	R5	Revised approximate weight of 500 kVa and larger concrete pad from 2,000 to 3,000 (Table, page 2).
Z1-06	Civil Hardware and Associated Materials	R5	- Revised diameter of Non-Traffic duty covers: - Concrete cover (small) changed from 610 to 675, - Cast-iron cover (large) changed from 610 to 680, - Concrete cover (large) changed from 787 to 860, and - Cast-iron cover (large) changed from 787 to 875.
Z2-01	Duct and Accessories	R2	- Revised acronym from FRE to RTRC to align with CSA standards, - Added nominal wall thickness (NOM WT) descriptor to RTRC duct, - Added 75 mm and 100 mm 90 degree RTRC bends (page 1), - Added 125 mm 45 degree RTRC bend (page 1), - Added 125 mm 22 ½ degree RTRC bend (page 2), - Added 30 degree bends (page 2), - Added 125 mm 11 ½ RTRC bend (page 2),

		- Deleted transite to PVC transition couplings (page 3), - Added RTRC to PVC (Schedule 40 and DB2) (page 3), and - Added 125 mm RTRC bell end (page 4), - Added epoxy adhesives (Duct Accessories, page 5).
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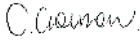
3.0 Action

New and revised ES54 standards are effective immediately and can be found on the [Distribution Standards Wiki](#) or [extranet site](#). If you have a printed copy of the ES54 manual please ensure you download and replace the relevant pages.

4.0 Distribution Standards Contact

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5.0 Approval

Recommended		Reviewed		Approved	
					
C. CROWSON		L. STEVANOVIC		F. DENNERT	
Date:	Oct 31, 2018	Date:	Oct 31, 2018	Date:	Oct 31, 2018