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b) for the purpose of connecting equipment to BC Hydro equipment;
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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.

Information Bulletin:

Revised ES54 S0-02 Services General Notes and Release of ES54 S0-05 Service Ducts and Trenches

Revision Note

This revised advisory 2022-010 R1 describes the latest revisions to ES54 S0-02 (R2) and S0-05 (R1):

- Changed content is marked in the revised standards by green vertical revision lines in the left margin.
- This advisory is referenced by number in the Revision Notes sections of the affected standards.
- ES54 S0-02 R2 and S0-05 R1 have been released and posted online. The previous revisions of the standards (ES54 S0-02 R1 and S0-05 R0) are appended to this advisory for reference to help make it easier to understand the changes.

1.0 Items Covered

ES54 S0-02 R2 Services General Notes
ES54 S0-05 R1 Services General Notes Service Ducts and Trenches

2.0 Overview

This revised bulletin is a continuation-in-part to the original EA2022-010 R0 advisory issued November 25, 2022, describing subsequent changes made to ES54 S0-02 and S0-05. These changes were made over the past six-month period in response to comments and requests received from internal and external stakeholders.

Distribution Standards has revised ES54 S0-02 as follows:

Page	Section	Changes
1	Application	• Added note that standards with latest issue date take precedence when there is a conflict or inconsistency

Page	Section	Changes
2	Supply Authority Requirements	• Added note that BC Hydro installation crews have authority to reject a customer request for service connection if there is discrepancy between the electrical service agreement and the service equipment installed
2	Customer Scope of Supply	• Added note that copy and paste of BC Hydro standards shall not be used as generic installation details for building permit drawings • Revised and expanded the definition of civil works on private property
3-4	Service Equipment Located in High Flood Plain Area	• Added new section for customer service elevation compliance per BCEC Rule 6-206 (1)(c)(v) • Added Figure 1 *Service duct profile and service vault for high flood level buildings*

Distribution Standards has also revised ES54 S0-05 as follows:

Page	Section	Changes
1	Application	• Clarified that utility civil work on private property, other than service ducts and trenches, shall comply with ES54 sections H and W
1	Revision Notes	• Added R1 changes
1-2	Note 2 Materials	• Note 2.b changed '200 A and less' to 'less than 400 A' for exemption for depth of burial • Note 2.e clarifies drainage tee being higher than finished grade
3	Note 3.2 Installation Requirements, Service in Duct	• Note 3.2.h revised customer requirements for submission: - A certified engineered design that prevents shearing of service ducts; or - A certified geotechnical statement confirming that there's no differential settlement that may cause damage to service ducts • Note 3.2.i minor clarification changes
4-7	Drawings	• Removed Section B from previous page 5 • Added callout Elevation 2 – concrete encased service duct page 6 • Removed Elevation 3 from previous page 7 • Removed Elevation 4 from previous page 8 • Added extra concrete inserts around ducts to Section C (page 7)

3.0 Action

ES54 S0-02 R2 and S0-05 R1 are effective July 31, 2023. Applications for work approved by the local BC Hydro design office on or after July 31, 2023 shall meet the requirements of these new revisions. Work approved prior to July 31, 2023 may comply with the previous revisions (ES54 S0-02 R1 and S0-05 R0) or may choose to comply with the new revisions.

Designers and Engineers

Designers and engineers should familiarize themselves with the revisions to ES54 S0-02 and S0-05.

Civil Inspectors

Civil inspectors should familiarize themselves with the revisions to ES54 S0-02 and S0-05.

Customers and Customer Representatives

Customers and customer representatives, including electricians, project managers, consultants, and contractors, should familiarize themselves with the revisions to ES54 S0-02 and S0-05. Please direct any questions or concerns to your local BC Hydro representative.

4.0 Approval

Recommended		Reviewed		Approved	
M. Kelvin		M. Stevens		H. Giesbrecht	
Date:	2023-06-30	Date:	2023-06-30	Date:	2023-06-30

Application

ES54 section S *Services* describes BC Hydro requirements for customer civil and electrical work on private property for supply services, including both medium-voltage (primary) and low-voltage (secondary) services.

This standard applies to all ES54 section S standards. ES54 section S does not cover requirements for renewable energy systems, energy production systems, and energy storage systems, nor the interconnection of customer-owned electrical power production sources.

For further information on BC Hydro rules for customer supply voltages, see BC Hydro distribution instruction DI S10-4 *Electric Service Connections – Voltages*.

Revision Notes

R1 – Major revision. Added sections *Electrical Safety Regulation – Application to Utilities* and *Utility Access*. Removed sections *Primary Services*, *Secondary Services*, *Wireways and Pull Boxes*, *Cable Pulling*, and *Grounding*. Other minor revisions. November 2022, MS

R0 – New standard, original issue. March 2016, MK

Reference Standards

ES54 S0-05 General Notes, Service Ducts and Trenches

Reference Documents

BC Hydro Electric Tariff

DI S10-4	Electric Service Connections – Voltages
BCEC	Canadian Electrical Code, Part I (CSA C22.1) adopted for BC and enforced by Technical Safety BC (TSBC)
BC Reg. 100/2004	Safety Standards Act Electrical Safety Regulation
TSBC D-EL 2017-01	Directive: Exemptions to public utilities
TSBC IB-EL 2017-04	Information Bulletin: Electrical Safety Regulation application to public utilities

Electrical Safety Regulation – Application to Utilities

BC Reg. 100/2004 *Safety Standards Act Electrical Safety Regulation* (ESR), except for section 3.1, does not apply to BC Hydro with respect to electricity distribution.

TSBC directive D-EL 2017-01 *Exemptions to public utilities* clarifies the demarcation point separating regulated electrical work from utility work on private property. See TSBC bulletin IB-EL 2017-04 for further information.

The customer shall supply, install, and maintain civil work and structures required for underground supply service connections on private property at their own cost, as per the BC Hydro Electric Tariff.

Civil and electrical work on private property for the purpose of electrical distribution by the utility that is exempt from the ESR shall be built to BC Hydro standards.

Supply Authority Requirements

Customer secondary and primary service locations and connection details shall comply with BC Hydro requirements as the supply authority as stipulated by BCEC sections 6 and 36 respectively and the BC Hydro Electric Tariff.

The unmetered portion of the service connection shall be secured by seal or BC Hydro padlock for BC Hydro restricted access only.

Revenue metering equipment, including access and radio link antennae, shall be installed in compliance with BC Hydro Revenue Metering department requirements.

BC Hydro supply service cables shall be installed in a duct. Direct buried supply service cables are not acceptable.

The customer shall dig a service trench, install service ducts, and cover with backfill in compliance with ES54 S0-05 *General Notes, Service Ducts and Trenches*. The customer does not require a duct installation permit nor inspection by the local regulatory authority.

BC Hydro service connection is based on a 50-year service life expectancy.

Utility Access

BC Hydro requires unobstructed access to the service equipment to safely isolate the service in an emergency. Service equipment and point of connection locations shall be acceptable to BC Hydro.

BC Hydro requires unobstructed access to revenue metering equipment.

Customer Scope of Supply

The location and installation details of service equipment on private property shall be clearly shown on building permit drawings and shall be accepted by the local regulatory authority building department and the BC Hydro designer.

The customer scope of supply includes service equipment, civil work, and ducts on private property, from the utility supply service duct stub-off (located at the property line) to the point of delivery inside the customer service equipment. Civil works on private property, including ducts, grounding, concrete pads, bollards, and pull boxes (including materials supplied by BC Hydro), are owned by the customer and shall be repaired and maintained by the customer. The applicable portion of the service installation and equipment, including the supply service conduit drain, shall be inspected by the BC Hydro civil inspector.

Supply ducts inside a building shall be engineered to support the weight of the concrete, ducts, and supply service cables, and to withstand all cable pulling forces (provided by a BC Hydro designer) during the installation and removal of supply service cables.

Supply service ducts entering pull boxes, pull pits, duct wells, and wireways shall be terminated into bell ends to minimize damage to BC Hydro supply service cables. Bell ends shall be finished flush with the concrete surface and comply with any other applicable reference standards.

Consulting Agreements

Customer work performed without prior consultation with BC Hydro, and work performed that is not in compliance with submitted BC Hydro electrical service connection forms, runs the risk of BC Hydro requiring changes to the service entrance equipment or equipment location.

The customer shall obtain agreement from the local BC Hydro design office for the following:

a. Service location;

b. Pull box design for service runs longer than 50 m or aggregate bends greater than 135°;

c. Deviations from BC Hydro ES54 S0-05 due to local conditions, including engineering details for duct entry into building foundation walls for building settlement and backfill differential settlement; and

d. Suitability of the supply service conduit and pull string for cable pulling before commencing backfilling.

Application

This standard describes BC Hydro requirements for customer civil work on private property for supply service ducts and trenches for all services (primary, secondary, single-phase, and three-phase). For BC Hydro requirements for BC Hydro civil work on public corridors, see ES54 sections H *Duct* and W *Construction Specifications*.

Revision Notes

R0 – New standard. November 2022, MS

Reference Standards

ES54 S0-02	Services General Notes

Reference Documents

ASTM D2487	Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System)
BCEC	Canadian Electrical Code, Part I (CSA C22.1) adopted for BC and enforced by Technical Safety BC (TSBC)
CSA A23.3	Design of concrete structures
CSA C22.2 No. 211.1	Rigid types EB1 and DB2/ES2 PVC conduit
CSA C22.2 No. 211.2	Rigid PVC (unplasticized) conduit
CSA C22.3 No. 7	Underground systems

Notes

1. Types of Installation

Direct burial of supply service ducts on private property. BC Hydro does not accept direct burial of supply service cables.

2. Materials

a. Materials from the stub-off on private property shall be supplied, installed, and maintained by the customer.

b. Minimum burial depth for supply service ducts should be 900 mm below finished grade. Sections of secondary services 200 A and less that cannot meet the minimum burial depth shall be mechanically protected using the methods described in note 2.n. The cover layer shall not be reduced and the burial depth shall at no point be less than 450 mm without the local BC Hydro distribution engineer's acceptance. Service ducts for primary services and 400 A and greater secondary services that cannot meet the minimum burial depth require the local BC Hydro distribution engineer's acceptance prior to installation. See note 2.l.

c. Underground and concrete encased ducts and fittings shall be CSA-certified grey rigid-type DB2/ES2 PVC CSA C22.2 No. 211.1 or grey rigid PVC duct CSA C22.2 No. 211.2 (Schedule 40 PVC).

d. Above ground exposed ducts and fittings shall be grey rigid PVC duct CSA C22.2 No. 211.2 (Schedule 40 PVC).

e. A drainage tee is required to drain water from the supply service duct before it enters service equipment or penetrates a building envelope. A drainage tee is not required when the perimeter building drain or bottom of the drainage tee drain gravel pit is above the BC Hydro service duct stub-off elevation.

f. The minimum nominal bending radius of ducts and fittings is 900 mm for 75 mm (3”) and 100 mm (4”) ducts and 1050 mm for 125 mm (5”) ducts.

g. Pull string shall be #8 polypropylene string or greater.

h. Cover and base fill material shall be screened sand or earth with a maximum partial size of 4.75 mm as per ASTM D2487, compacted to 95% modified proctor density to ensure adequate heat dissipation, drainage, and compaction, and to prevent mechanical damage to the direct buried ducts. See Sections A and B and Elevations 1 through 5.

i. Backfill material shall be selected native material for non-traffic areas compacted to 85% modified proctor density. Selected native material shall be granular material free from frozen lumps, ashes, refuse, vegetable, organic or foreign matter, granular material over 100 mm in any dimension, or other deleterious materials. See Sections A and B and Elevations 1 through 5.

j. Surface restoration is the customer’s responsibility. 100 mm of surface layer material is recommended when matching existing grade.

k. For traffic areas such as driveways and parking lots, backfill and road surface preparation or restoration shall be per the local regulatory authority having jurisdiction (AHJ) specifications, such as the MMCD or a city's design criteria manual. A permit from the local regulatory AHJ is likely required for road surface restoration work.

l. Service trenches shall have 150 mm wide “Caution Buried Electrical Line Below” tape or board installed along the centreline of the trench. Caution boards are required for primary services and reduced depth secondary services. See Sections A and B and Elevations 1 through 5.

m. 15M concrete rebar inserts are required on zero clearance applications for BC Hydro to join reinforced concrete duct bank to the building foundation wall. The customer shall supply the corresponding threaded splice bar to the insert, minimum length 200 mm (8”), to BC Hydro. See Elevation 6.

n. Riser sections above the minimum burial depth shall have adequate mechanical protection per BCEC rule 12-102 (3) or CSA C22.3 No. 7 rule 7.3.2. See Elevations 2 and 3. This is not required for surface mounted risers visible from the exterior of the building. See Elevation 1.

3. Installation Requirements

3.1 General

a. BC Hydro civil work requirements are based on 50-year service life expectancy.

b. Civil work, materials, and maintenance related to this standard are the customer's responsibility.

c. The service duct trench shall be in direct line-of-sight from the property line stub-off to the service duct entry into the building. The base of the trench shall be graded to the depth of the BC Hydro duct stub-off, typically 900 mm to the top of the BC Hydro duct.

d. The minimum separation from service ducts to other underground systems shall be 300 mm, except for roof / auxiliary drains or when the service duct is concrete encased or otherwise mechanically protected per CSA C22.3 No. 7, in which case the minimum separation may be reduced to 50 mm. See Plan 1 and Elevation 1.

3.2 Service in Duct

a. The customer shall couple their duct onto the BC Hydro duct stub-off at the property line and discard any markers or duct caps. Customer ducts shall not cross the property line nor enter BC Hydro's service box directly. The customer duct may only be coupled to the designated BC Hydro service duct.

b. BC Hydro may require a customer-owned BC Hydro standard pull box if the length of service duct between the BC Hydro duct stub-off and the service entrance exceeds 50 m. Please consult with your BC Hydro designer.

c. BC Hydro may require a customer-owned BC Hydro standard pull box if the total sum of duct bends in the service duct between the BC Hydro duct stub-off and the service entrance (including any 90° vertical riser) exceeds 135°. Please consult with your BC Hydro designer.

d. The customer is responsible for installing adequate service duct drainage in accordance with BC Electrical Code rules.

e. A pull string shall be installed in the service duct and tied securely at the service entrance and to the string in the BC Hydro duct stub-off. If no string is found in the stub-off, the customer shall contact BC Hydro for further instructions.

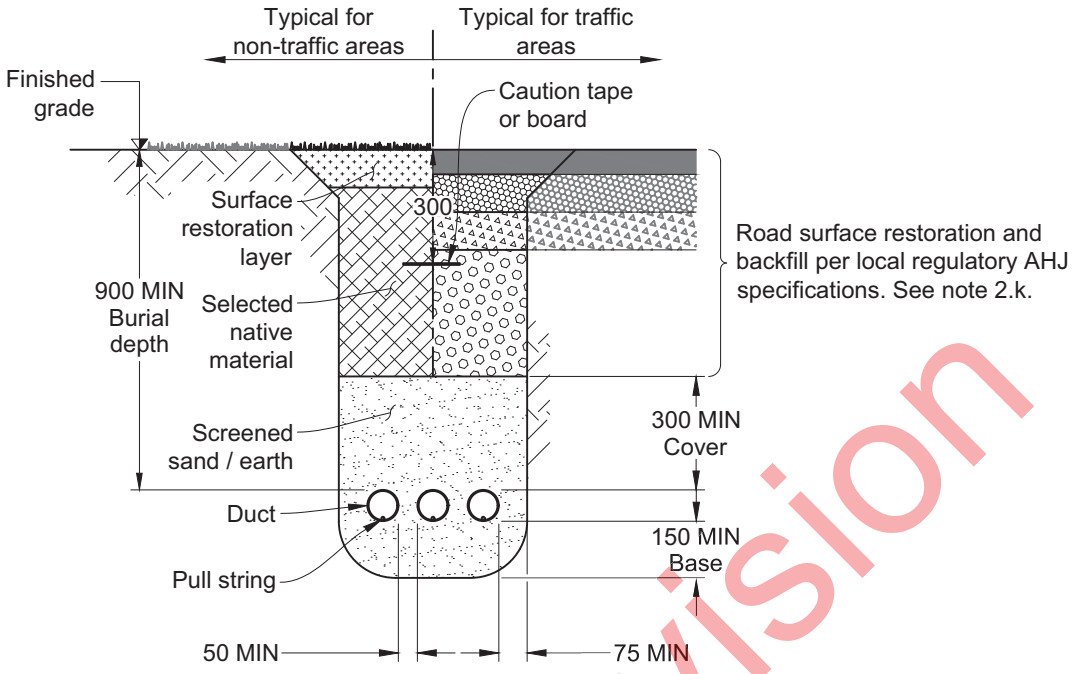
f. The service duct shall be kept free of obstructions and foreign material, including sand and gravel, throughout its length. The duct shall be proved by mandrel test before the final connection is made to the BC Hydro duct stub-off and before a pull string is installed.

g. The service duct shall be protected from damage caused by foundation settlement and excavation backfill. To minimize settlement and subsequent damage to the service duct and supply service cable, fill material shall be as per note 2 and compacted in 150 mm lifts.

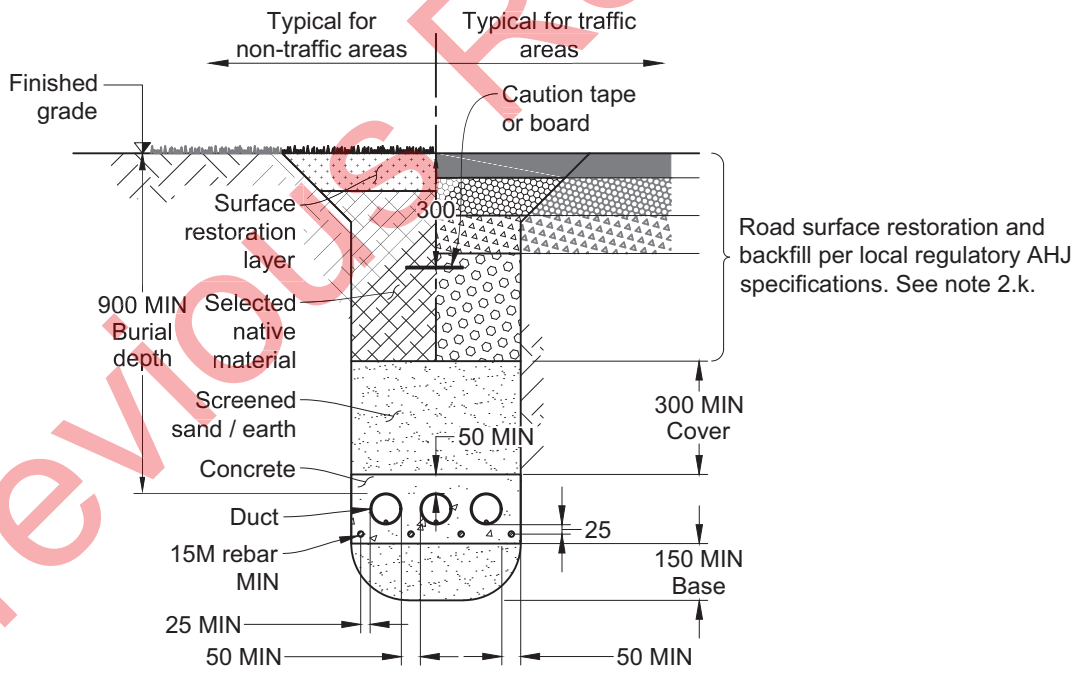
h. Service ducts for secondary services 400 A and greater and all primary services shall be encased in reinforced concrete when penetrating a foundation wall to protect form shear forces due to backfill settlement. Rebar reinforcement shall extend a minimum 1000 mm past the building foundation excavation line. Minimum rebar size shall be 15M. The minimum number of longitudinal reinforcements shall be one more than the number of service ducts. See Figure 1 for an image of service ducts sheared due to settlement and lack of rebar reinforcement. See Section B for suggested rebar placement for customer-owned duct banks and Section C for the required location of concrete inserts for zero clearance applications. Secondary services 200 A and less are exempt from this requirement.

i. The connection between the reinforced duct bank and the foundation wall at the point of duct penetration shall be joined with a CSA approved rebar connection or splice system to prevent the shearing of ducts due to settlement. Cast-in anchors/inserts, post-installed expansion (torque-controlled and displacement-controlled), undercut, and adhesive anchors are permitted to be part of the mechanical rebar connection or splice system provided they meet the requirements of CSA A23.3 Annex D. The minimum size of the rebar connection or splice system is 15M and shall meet the spacing requirements shown in Sections B and C.

Figure 1 – Service ducts sheared due to settlement and lack of rebar reinforcement



A 5 Section A - Supply service trench direct buried
Scale 1:20



B 5 Section B - Supply service trench reinforced concrete encasement
Scale 1:20

DESIGNED	RECOMMENDED	ACCEPTED	ENGINEER OF RECORD
M. STEVENS	M. KELVIN	H. GIESBRECHT	PROFESSIONAL ENGINEER PROVINCE OF BRITISH COLUMBIA M. P. STEVENS # 42517 2022-11-24 EGBC PERMIT 1002449

DISTRIBUTION STANDARDS BC Hydro

ISSUED: NOV 2022
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ORIGINALLY ISSUED: NOV 2022

SERVICES GENERAL NOTES SERVICE DUCTS AND TRENCHES

ES54 S0-05.05

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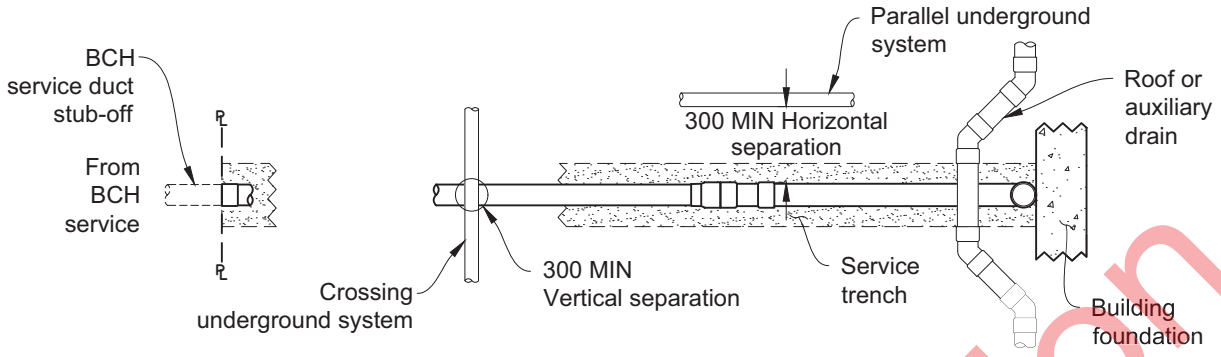
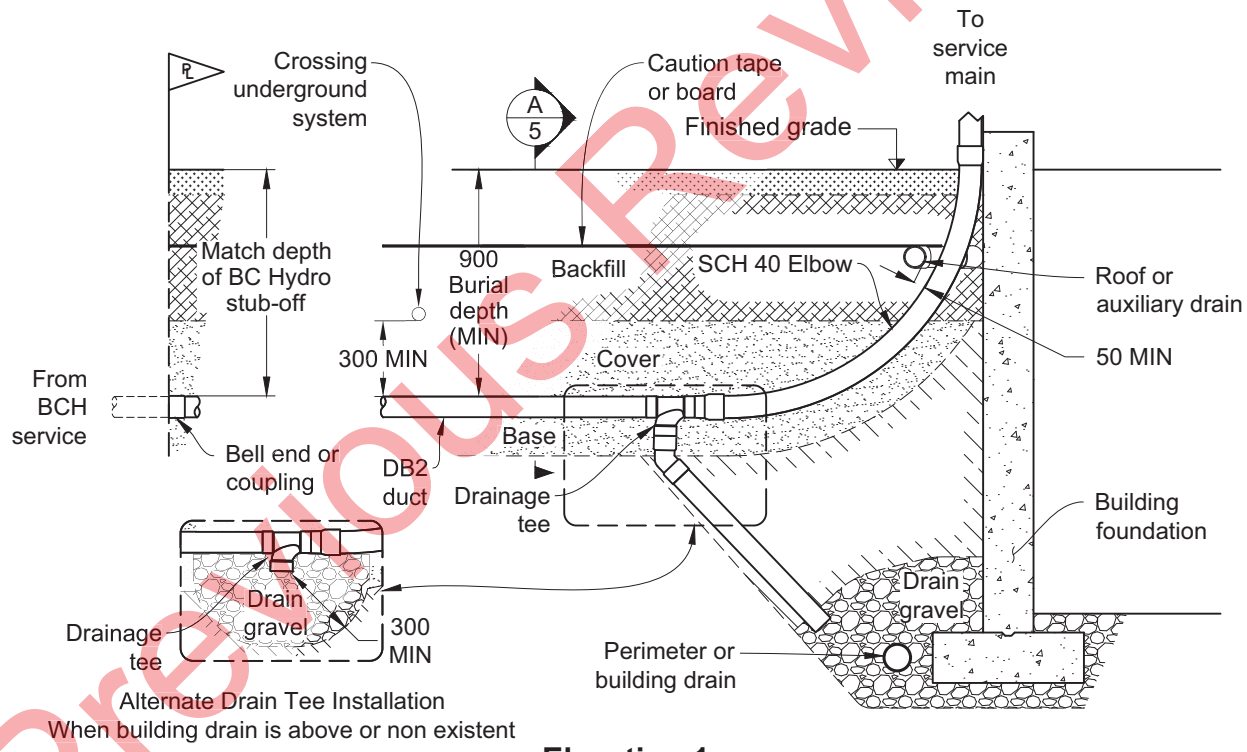


Plan 1
Adjacent and crossing underground systems
Scale 1:30



Elevation 1
Surface mount service riser
Scale 1:30

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SERVICES
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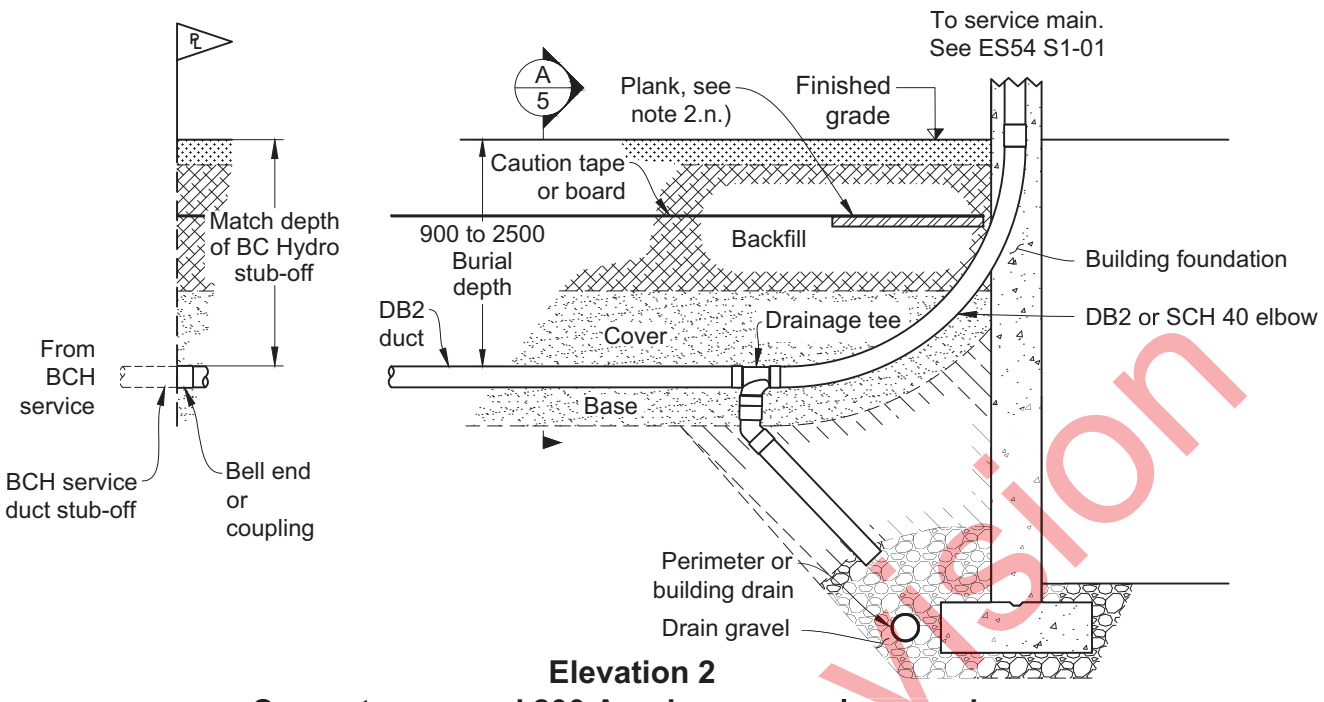
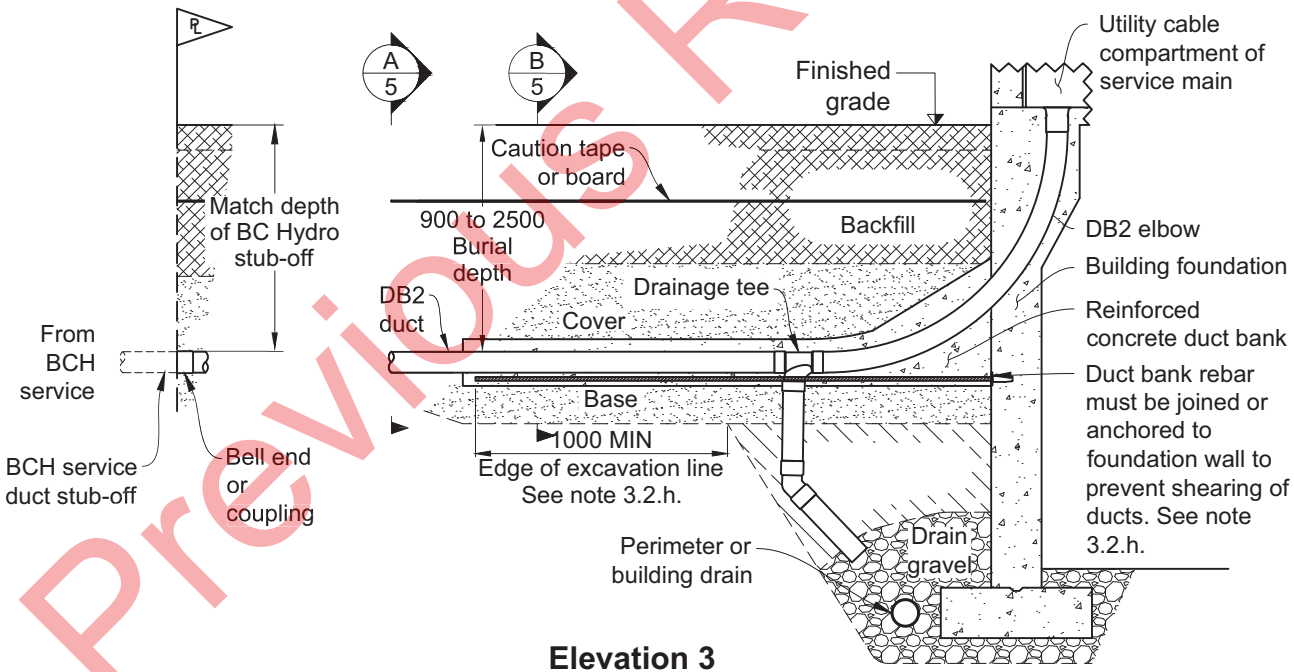
SERVICE DUCTS AND TRENCHES



Elevation 2
Concrete encased 200 A or less secondary service
Scale 1:30



Elevation 3
Foundation wall penetration - vertical up
Scale 1:30

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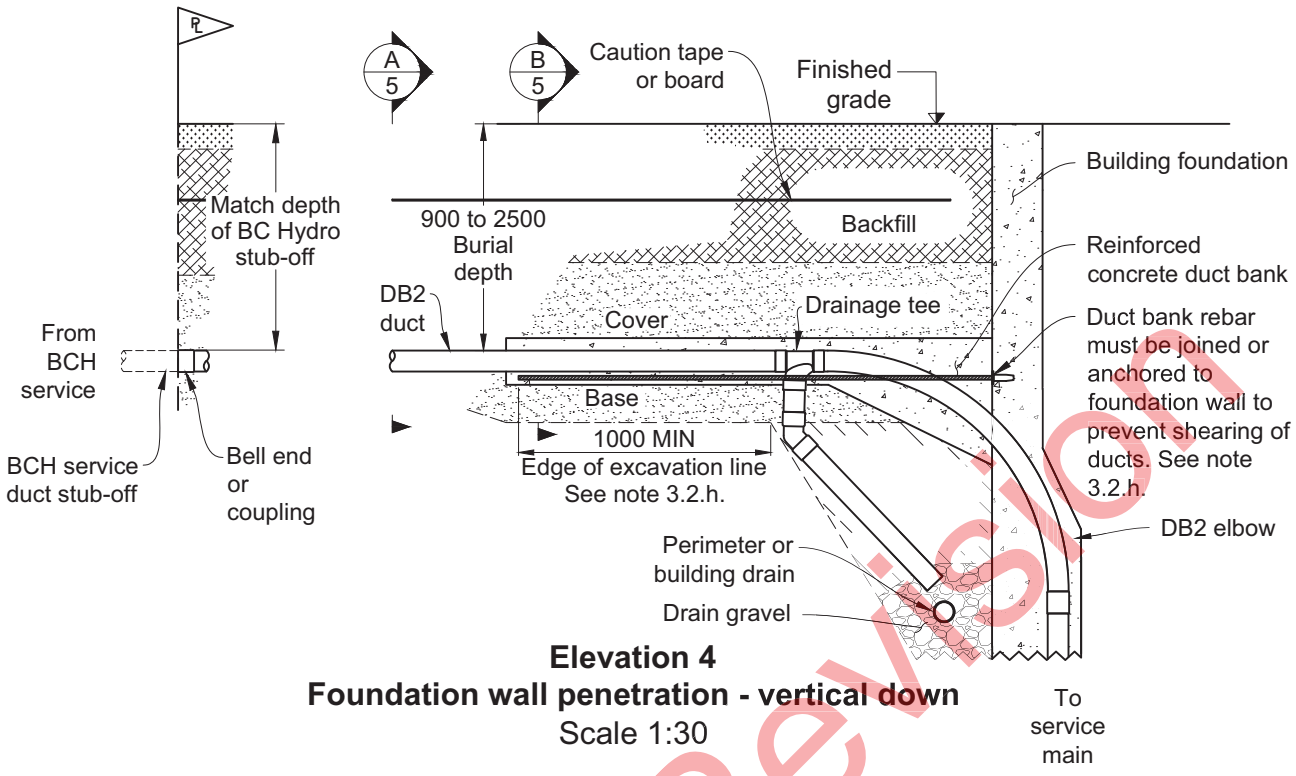
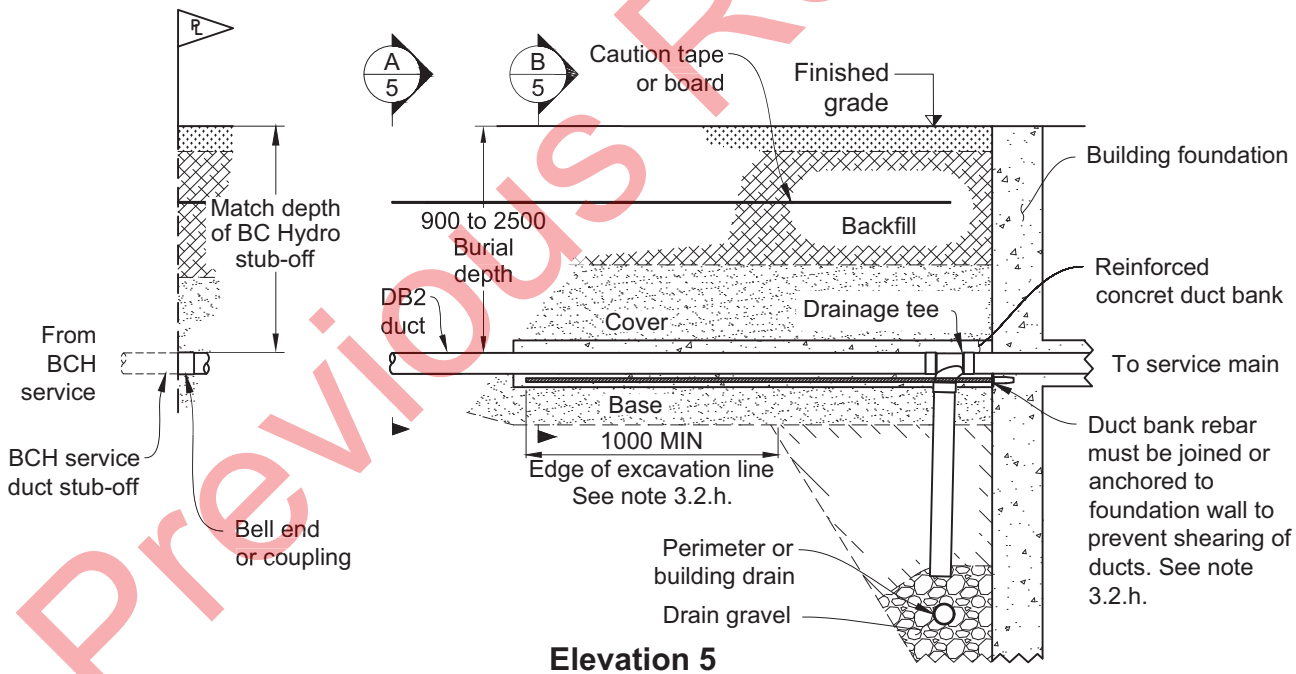
SERVICES
GENERAL NOTES
SERVICE DUCTS AND TRENCHES



Elevation 4
Foundation wall penetration - vertical down
Scale 1:30



Elevation 5
Foundation wall penetration - horizontal
Scale 1:30

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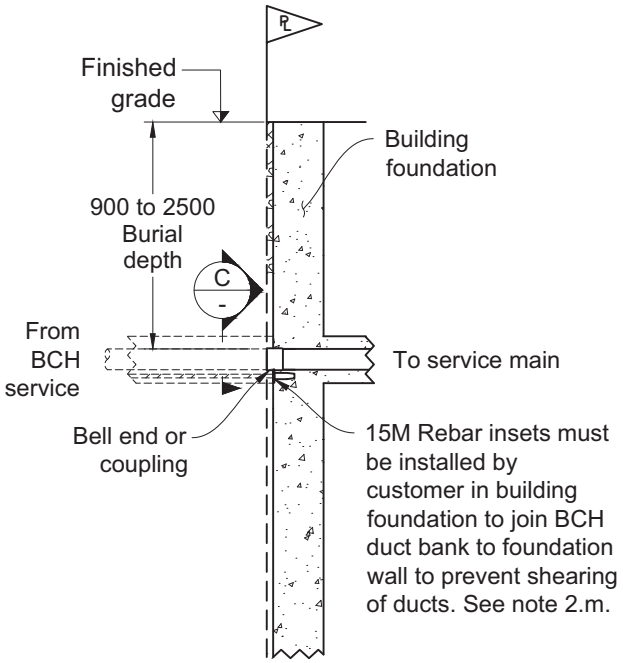
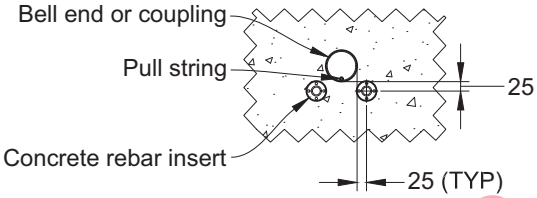
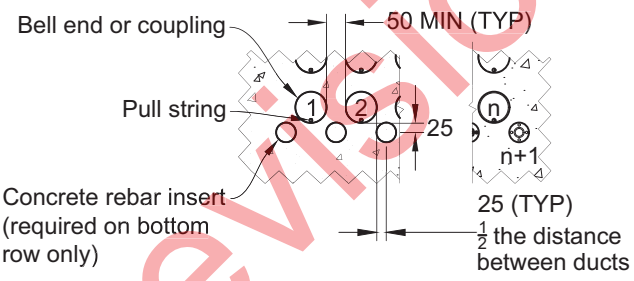
		PAGE 8 OF 9	ES54 S0-05.08 R 0



Elevation 6
Foundation wall penetration zero clearance
Scale 1:30



C1 - Section C1 - Single duct service
Scale 1:20



C2 - Section C2 - Multi duct service
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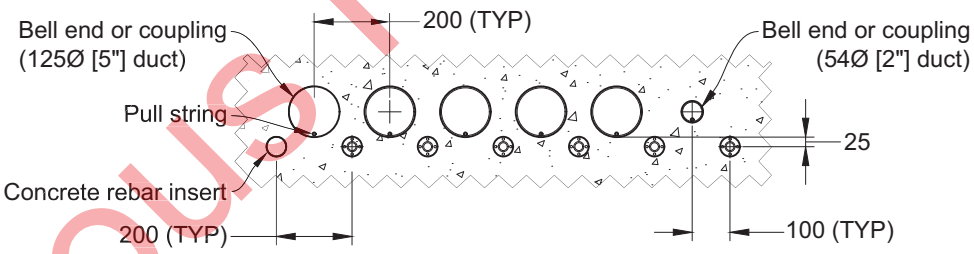

C3 - Section C3 - Six duct service to BC Hydro switchwear
Scale 1:20

4. Drawing Notes

a. Dimensions are in millimetres unless noted otherwise.

b. Ducts shown are 75 mm nominal (3") unless noted otherwise.

c. Figures show BC Hydro's minimum requirements. Alternative installations that exceed these requirements are acceptable.

DESIGNED	RECOMMENDED	ACCEPTED	ENGINEER OF RECORD	SERVICES GENERAL NOTES SERVICE DUCTS AND TRENCHES	
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