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REVISIONS: UPDATED LEGAL ACKNOWLEDGEMENT FORM. FD MAR '16

DESIGNED	RECOMMENDED	ACCEPTED	ENGINEER OF RECORD	NOTICE FROM THE EXECUTIVE VICE PRESIDENT TRANSMISSION AND DISTRIBUTION AND CUSTOMER SERVICE	
J. AGNOLIN	F. DENNERT	G. REIMER	PROFESSIONAL ENGINEER PROVINCE OF BRITISH COLUMBIA F. U. DENNERT		
DISTRIBUTION STANDARDS BC Hydro	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.

REQUIREMENTS FOR CUSTOMER-OWNED PRIMARY SERVICES SUPPLIED AT 4 kV TO 35 kV

PRIMARY GUIDE

ISSUED: MARCH 7, 2018
EFFECTIVE DATE: JULY 1, 2018

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To view the latest version of this document, go to:
http://www.bchydro.com/distributionstandards

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Table of Contents

1 Interpretation

This document contains the requirements for the design, construction, installation, access and connection of customer-owned primary services supplied by the BC Hydro distribution system at 4 kV to 35 kV. Primary service connections are subject to BC Hydro's terms and conditions, which form part of the Distribution Tariff, according to the Distribution Instructions A10-2 Service Agreements.

Note 1: For electrical energy supply at 69 kV and above, refer to the *BC Hydro Guide and Requirements for Service at 69,000 to 287,000 volts*.

This Primary Guide is neither intended as a design specification, nor as an instruction manual for customer-owned primary services. This document shall not be used by the customer, nor his contractors or consultants for such purposes. Persons seeking to use the information included in the guide do so at no risk to BC Hydro and they shall rely solely upon themselves to ensure that their use of all or part of this document is appropriate in the particular circumstances.

BC Hydro customers, or their servants or agents, shall recognise the fact that they are, at all times, solely responsible for their own design, construction, installation or operation. Neither BC Hydro, nor any of its employees or agents, shall either be, or become, the agent of the customer in any manner howsoever arising.

BC Hydro's review of the specifications and detailed plans shall neither be construed as conforming to or endorsing the design, nor as warranting the safety, durability or reliability of the customer-owned primary service. BC Hydro, because of such review or lack thereof, shall neither be responsible for the strength, adequacy of design, nor capacity of equipment built pursuant to such specifications, nor shall BC Hydro or any of its employees or agents, be responsible for any injury to the public or workers resulting from the failure of the customer-owned primary services.

In general, the assertion by BC Hydro, or any of its employees or agents, that the customer-owned primary service equipment design meets certain limited requirements of BC Hydro does not mean, expressly or by implication, that all or any of the requirements of the law or other good engineering practices have been met by the customer-owned primary service, and such judgement shall not be construed by the customer or others as an endorsement of the design, nor as a warranty, by BC Hydro or any of its employees or agents. Furthermore, if the customer opts to install BC Hydro standard products certified for utility use, the customer's engineers and contractors assume full responsibility and liability for the application, installation, approval and use of such products and structures.

It is not the duty or the function of BC Hydro to interpret or enforce the Canadian Electrical Code as applicable to the customer-owned electrical installation.

Note 2: The 2017 edition of the Primary Guide supersedes the 2010 edition. The effective date when these requirements become mandatory is 1 July, 2018.

2 Definitions

Acceptable — certifies that the customer-owned primary service design and specifications follow BC Hydro's requirements for the Primary Services Guide.

Annual Operating Permit — a permit to operate, maintain and carry out minor alterations to the customer primary service, per the TSBC (formerly BCSA) British Columbia Safety Standards Act.

Approved Equipment — electrical equipment certified by a certification agency accredited by the Standards Council of Canada in accordance with the requirements of the CSA standards, or other accredited documents where such CSA standards do not exist or are not applicable.

Authorization for Connection — the BC Hydro form issued by Distribution Design authorizing a customer service connection to the BC Hydro utility distribution system.

BC Hydro Designer — Technologist or Engineer in BC Hydro's employ responsible for processing the customer application for primary service connection and adherence to BC Hydro requirements and Distribution Standards.

BCEC — British Columbia Electrical Code, CSA22.1 Canadian Electrical Code, adopted and amended by TSBC (formerly BCSA) for the Province of British Columbia.

BCSA — British Columbia Safety Authority — name now changed to TSBC (Technical Safety BC). Responsible for administering BC Electrical Code. All documents identified as BCSA in this document shall be interpreted as TSBC.

BIL — Basic Impulse Level, as defined by CSA Standards.

Conduit — a raceway of circular cross-section into which it is intended that conductors be drawn.

Consumer's Service — all that portion of the consumer's installation from the service box, or its equivalent, up to and including the point at which BC Hydro, as a supply authority, makes a connection.

Current Permit — written permission from the inspection department to a supply authority, stating that electric energy may be supplied to a particular installation.

Customer — any individual, person, partnership, company or other entity receiving services from BC Hydro.

Dead Zone in Primary Switchgear – portion of service main, source side of a breaker, where customer protection CTs are located on the load side of the service main breaker.

Distribution Operating Order (formerly Local Operating Order) — a special operating or maintenance procedure issued by BC Hydro to attend to, operate and maintain certain equipment or apparatus connected to the BC Hydro distribution system.

Distribution Standards — standards for construction of the BC Hydro electrical distribution plant within the service area of BC Hydro.

Electric Service Agreement — formal, legally-binding contract between BC Hydro and the customer, that sets forth the terms of supply of electrical energy.

Instrument Transformer Compartment — a switchgear cell or a section of the primary service assembly, consisting of an enclosed metal box or cabinet constructed so that it may be effectively locked or sealed, containing revenue metering transformers.

Isolating Switch — a switch intended for isolating a circuit or equipment from its source of supply, which shall not be used for interrupting the flow of current.

Licensed Electrical Contractor — a person who holds a licence as a licensed contractor for the class of electrical equipment or electrical installation defined by the TSBC (formerly BCSA).

Meter Cabinet — a lockable, wall-mounted metal box, containing a Measurement Canada-certified BC Hydro revenue meter, connected to the revenue metering instrument transformer compartment.

Point of Connection — a physical location in the primary service equipment where BC Hydro, as a supply authority, terminates service cables or conductors to deliver electrical energy.

Primary Guide — BC Hydro document containing the requirements for design, construction, installation, access and connection of customer-owned equipment for primary services supplied by the BC Hydro distribution system at 4 kV to 35 kV.

Primary Service — the customer's service equipment, indoor or outdoor, connected to BC Hydro, as the supply authority, at primary distribution of 4 kV to 35 kV.

Primary Service Declaration — BC Hydro form entitled "Statement to BC Hydro Regarding Primary Voltage Service Entrance Equipment" ("Primary Service Declaration") available at all design offices (see Section 5.2.5. of this Primary Guide).

Primary Service Dual Supply — large loads (exceeding 6.5 MVA in a 7.2/12.5 kV area or exceeding 13.0 MVA in a 14.4/25 kV area) which may be served by two feeders, or customers requiring extraordinary service reliability.

Primary Service Kiosk — customer-owned outdoor structure containing an incoming service cable compartment, service switch or a breaker, and the outgoing cable compartment for connection of customer-owned cables. The kiosk may also include a revenue metering cubicle, a service transformer and secondary switchgear as a complete unitized substation.

Primary Service Switchboard — switchgear assembly, or portion thereof, consisting of one or more switchgear cells, containing a primary service cable termination compartment, a service switch or a breaker and associated relaying and, where applicable, a primary revenue metering cubicle.

Primary Service Vault — see Service Vault.

Primary Voltage — voltage above 750 V measured phase to phase.

Professional Engineer — a registered professional engineer with qualifications in electrical engineering and registered with APEGBC in good standing in the Province of British Columbia.

Protective Barrier — a permanent or removable insulation board or a fitting, mounted separately from the exposed electrical components, to prevent contact with energized components.

Pull Box — an approved metal or concrete box to facilitate installation of service cables or conductors.

Regional Distribution Engineer — a Professional Engineer in BC Hydro's employ, responsible for a designated portion, or a geographic area, of the BC Hydro distribution system.

Registered Class A Electrician — a licensed electrical contractor with unlimited voltage restriction and trade qualifications per the TSBC (formerly BCSA) Safety Standards Act.

Regulatory Authority — the ministry or local government that provides for inspection services and has the authority to require inspection of electrical work in the Province of British Columbia.

Rigid Metal Conduit — a rigid conduit of metal pipe made to the same dimensions as standard pipe and suitable for threading with standard pipe threads.

Secondary Voltage — voltage up to and including 750 V, measured phase to phase.

Service Box — an approved assembly consisting of an enclosure that can be locked or sealed, containing either fuses and a switch, or a circuit breaker, and of such design that it is possible to operate either the switch or circuit breaker to the open position by manual means when the box is closed.

Service Connection — part of BC Hydro's distribution facilities extending from the first attachment point on BC Hydro's distribution system to the point of connection.

Service Vault — a room or a space in a building to accommodate service equipment, and constructed in accordance with the National Building Code of Canada and applicable local legislation and bylaws.

Supply Service — any one set of conductors run by a supply authority from its mains to a consumer's service.

Supply Service Cable Compartment — a switchgear cell, or a section of the primary service assembly, containing primary service cables or conductors, and consisting of an enclosed metal box or cabinet, constructed so that it may be effectively bolted down with three penta bolts, and locked by a BC Hydro padlock or sealed.

Single Radial Supply — comprising the incoming cable termination and a gang-operated disconnect or loadbreak switch.

Statutory Right-of-Way — a registered right-of-way on private property or inside a customer-owned building granted by the owner to BC Hydro for its function as an electric utility.

Supply Authority — any individual, person, partnership, company or other entity in British Columbia supplying electric energy.

TSBC (Technical Safety BC) — (previously BCSA, British Columbia Safety Authority) responsible for administering the BC Electrical Code. All documents identified as BCSA in this document shall be interpreted as TSBC.

Visible Disconnection Point — a physical location in primary service equipment where supply may be interrupted, and that allows direct and safe visual confirmation of separated contact by BC Hydro personnel, without the use of climbing structures.

3 System Requirements

3.1 Design and Compliance

The overriding concern of BC Hydro is the safety and reliability of each primary service. All new primary service equipment shall be rated and certified for operation at 14.4/25 kV, although in some areas initial operation at 7.2/12.5 kV may be required. For some rural areas, the BC Hydro distribution supply is 19.9/34.5 kV.

> **Note 3:** BC Hydro shall not supply any customer primary service, regardless of geographic location, which is designed and constructed to operate as a three-phase two-wire service.

All customer-owned primary service equipment and installations shall be technically compatible with the BC Hydro distribution system, to ensure public safety and to facilitate safe and reliable delivery of electrical energy. BC Hydro distribution systems are built in accordance with the BC Hydro Distribution Standards, which are developed, maintained and approved by Professional Engineers. Accordingly, customer-owned primary services shall also be designed and certified by Professional Engineers. Any deviations from the BC Hydro Distribution Standards shall be accepted and approved by the BC Hydro Regional Distribution Engineer in charge of the project.

All customer-owned primary services are within the jurisdiction of the TSBC (formerly BCSA) and all equipment shall be CSA certified. Therefore, the installation shall be completed in compliance with the BC Electrical Code by a Class A electrical contractor licensed by the BC Safety Authority and in good standing. However, the Ministry of Mines, the Port Authority, railway companies, etc. are exempt from the BC Electrical Safety Regulation, acting as the Authority Having Jurisdiction (AHJ). Customers exempt from the BC Electrical Code shall provide BC Hydro with a confirmation letter from the Authority Having Jurisdiction that a subject primary service is suitable for connection to the BC Hydro distribution system.

In the event that the customer's primary service does not meet BC Hydro's requirements, the installation may be connected and maintained under a special provision of the Distribution Operating Order, which may carry extraordinary charges to the customer for each service call, and regular inspection and maintenance, as required, by BC Hydro personnel.

> **Note 4:** the customer-owned primary service equipment and installation are the jurisdiction of the BC Safety Authority and BC Electrical Code. Therefore, BC Hydro will not issue an Authorization for Connection for any customer-owned primary service prior to receipt of the Contractor's Declaration and a copy of the Annual Operating Permit held by a Class A licensed electrical contractor from a regulatory Authority Having Jurisdiction at the site.

3.2 Utility Access

Access to the primary service location on private property, and access to the service conductors and revenue metering, including the operation and safe isolation of the main service switch, shall be compliant with BC Hydro Work Methods, WorkSafeBC rules and the BC Hydro Electric Tariff.

For buildings requiring indoor primary service vaults, the vault should be accessible to BC Hydro personnel via an exterior door located at grade. For buildings where exterior door access to the vault is not possible, the vault may be in the parkade on the P1 level. Access to the underground building parkade shall be suitable for the 2.1-metre maximum vehicle height of BC Hydro service vehicles. For

buildings supplied by an open loop configuration, BC Hydro requires a special keyed switch access panel connected to the overhead door electric operator. For further information refer to paragraph 7.4.

3.3 Supply Configuration

Primary service supply configuration depends on the geographic location in the Province and the kVA rating of the service, as well as the overhead or underground service connection type.

Single Radial Supply — the most common configuration for overhead and underground supply throughout the Province — see the attached drawings PG A1-01 and PG A1-02. For overhead supply, the customer service connection includes a pole-mounted loadbreak switch and fused cutouts. For underground supply switchgear type services, the customer service may comprise the incoming cable cubicle and loadbreak switch with fuses, or an isolation switch in conjunction with a circuit breaker or an interrupter. Some indoor type installations use draw-out breakers.

Primary Loop Supply — an obsolete configuration, used in certain areas (e.g. Surrey, Victoria), as defined in the Electric Tariff.

Primary Open Loop Supply — in areas designated by BC Hydro, customers may receive a single radial supply from BC Hydro-owned switchgear that may be located within the customer premises in an inside room or outside space provided by the customer. The requirements for the switchgear space are outlined in the ES54 Underground Civil Standards.

For further information on switchroom requirements inside customer buildings, refer to the ES54 E6-01 standard: http://www.bchydro.com/distributionstandards

For further information on switchgear configuration, refer to DSR-2015-6043. http://hydroshare/sites/distplan/OfficialRelease/DesignPolicy_UG_Switchgear-BCH-DSR-2015-6043.pdf#page=22

Dual Radial Supply — an obsolete configuration comprising one running and one standby feeder, as per the attached drawing PG A11-01. Effective April 1, 2009, a customer requesting service in a previously designated dual radial area is offered single radial supply, or may be requested to provide space on his or her property for BC Hydro switchgear to facilitate Primary Open Loop supply.

Dual Supply — large connected loads, as defined by BC Hydro (typically exceeding 6.5 MVA in a 7.2/12.5 kV area or exceeding 13 MVA in a 14.4/25 kV area), may be served by two feeders — refer to the attached drawing PG A2-01. Customers connecting such large loads to BC Hydro's system shall consult with BC Hydro to establish connection requirements prior to commencement of building construction.

Dedicated Backup Supply — may be available upon customer special request at BC Hydro's discretion.

BC Hydro continues to upgrade the distribution system and to use remotely-operated automated switchgear for improved reliability of service. Consequently, dual radial and double dual radial service connections are no longer available for new construction in any geographical area. Currently, all BC Hydro primary customers will receive some form of a radial supply configuration with system redundancy. In some geographic locations, redundancy of the supply system could be provided by BC Hydro-owned switchgear, which may be located on the customer's private property or inside a customer-owned building, and may require a BC Hydro right-of-way.

Note 5: The customer shall contact the BC Hydro designer for the area regarding the supply configuration for a proposed primary service supply. For further information regarding special requirements and available feeder capacity, contact a BC Hydro representative.

3.4 Point of Connection

In general, the point of connection for overhead and underground primary service supply shall follow the applicable rules of the BC Electrical Code, Section 36, and BC Safety Directive D-E3 090313 1.

For overhead service, the BC Hydro point of connection shall be the first customer-owned pole located on private property.

For underground services, the BC Hydro point of connection shall be the utility service cable compartment above a cable pull pit located on a ground floor or P1, but not lower than the P2 level. A point of connection above ground level shall not be acceptable to BC Hydro.

For high flood plain areas and for outdoor kiosks, the cable pull pit may be replaced by a BC Hydro pull box located outside the building near the primary service, subject to acceptance by the BC Hydro designer.

If a customer installs non-compliant primary service equipment or has extenuating circumstances which result in the need to restrict BC Hydro access to the primary service location, BC Hydro requires a demarcation structure as the point of connection. This demarcation structure shall be pad-mounted and pre-approved by BC Hydro as the supply authority and by the Authority Having Jurisdiction. The demarcation structure shall be supplied and installed by the customer, and located inside the customer property line. The demarcation structure shall ensure a separation between the customer and the BC Hydro equipment in the form of a primary service kiosk, compliant with this document, or a pad-mounted enclosure design acceptable to BC Hydro. A BC Hydro standard 832 box shall no longer be acceptable. For further information on the requirements of a demarcation structure, refer to Appendix 2.

Note 6: BC Hydro shall not, under any circumstances, connect any customer service to a building or a structure which violates the minimum clearance requirements from the building or a structure to BC Hydro overhead lines, as stipulated by CSA 22.3 No.1 Overhead Systems and the BC Hydro ES43 Overhead Electrical Standards.

3.5 Revenue Metering

For overhead services, BC Hydro requires a separate, dedicated, customer-owned pole (typically the second pole on a private line) for the installation of a revenue metering assembly and associated surge arresters — see the ES43 J7 standard in Appendix 2. Customer-owned equipment shall not be installed on the revenue metering pole, except for surge arresters as per the attached drawing PG A1-02.

Note 7: All BC Hydro primary revenue metering for overhead and underground service connections shall be located after the customer service main overcurrent protection device(s).

For underground services, BC Hydro requires a separate metering cubicle with restricted access for BC Hydro personnel only. Customer-owned equipment shall not be installed inside a revenue metering cubicle.

For further information on primary metering, refer to *Requirements for Manually Read Primary Service Voltage Revenue Metering (4 kV to 35 kV)* at https://www.bchydro.com/distributionstandards

Where practicable, the point-of-metering (POM) shall be on the service transformer secondary side. However, subject to BC Hydro's approval, the POM may be on the primary side under special circumstances, including:

a) Multiple service transformers;

b) A single service transformer with multiple secondary windings;

c) A single service transformer with non-standard secondary voltage, or

d) A customer-owned primary voltage overhead power line.

Where the POM is on the secondary side, the revenue metering shall be in accordance with the BC Hydro document: *Requirements for Secondary Metering Installations (750 V and Less)* at https://www.bchydro.com/distributionstandards

Copies of all applicable BC Hydro distribution standards documents, including revenue metering documents, may be obtained from https://www.bchydro.com/distributionstandards

3.6 Power Quality

3.6.1 Voltage Planning Levels

Important network voltage characteristics for the design of customer facilities are frequency, steady-state range, and voltage unbalance; BC Hydro feeder planning levels for these voltage characteristics are summarized in this section. The detailed planning standards from the BC Hydro ES55 Design Standards, Section Q2, for these and all other voltage characteristics can be supplied upon request.

3.6.2 Voltage Frequency (ES55 Q2-02)

The BC Hydro primary voltage supply frequency is 60 Hz, with an acceptable performance deviation band of ±1.0 percent (59.4 – 60.6 Hz), per CAN/CSA-IEC C61000-2-2.

3.6.3 Steady-State Voltage (ES55 Q2-03)

The BC Hydro primary voltage supply shall comply with the CAN-C235-83 standard, stipulating voltage deviation not exceeding ±6.0 percent from the nominal supply voltage. Assessment of steady-state voltage performance requires that measured 200 ms r.m.s. voltages are aggregated over 10-min intervals, per CAN/CSA-IEC 61000-4-30. The first percentile and 99th percentile voltage levels measured over a one-week period shall fall with the prescribed CSA range; the analysis excludes measured quantities during outages and/or uncontrollable network faults.

3.6.4 Voltage Unbalance (ES55 Q2-07)

Supply voltage unbalance is less than 2.0 percent at standard locations and less than 3.0 percent at rural locations. Generally, all customers on non-integrated networks and all customers with points of

interconnection located greater than 20 km from the BC Hydro substation are considered rural. Assessment of voltage unbalance performance requires measurement of average negative-sequence voltage unbalance over 10-min intervals, per CAN/CSA-IEC 61000-4-30. The 95th percentile voltage unbalance level measured over a one-week period shall be within the prescribed planning level, and the 99th percentile voltage unbalance level shall be within 1.3 x the planning level.

BC Hydro Field Operations may cause single-phasing conditions on supply feeders when opening or closing individual phases of switching equipment.

Note 8: BC Hydro strongly recommends installing loss-of-phase protection for sensitive customer loads, which may be subject to damage from single-phasing conditions. In addition, special quality service for the supply of computers or similar sensitive equipment may be required to buffer their equipment against switching transients, which may occur on the BC Hydro distribution system.

3.6.5 Customer Emission Limits

Customer primary service performance shall comply with the BC Hydro emission limit requirements for flicker, rapid voltage changes, unbalance, and harmonic distortion. A customer found to be causing excessive disturbance to a BC Hydro feeder could be faced with service disconnection if they fail to install/enact suitable mitigation. For further information, refer to BC Hydro emission limit standards available at: www.bchydro.com/distributionstandards.

ES55 Design Standards - Section Q - Medium-Voltage Customer Emission Limits: Requirements for Customer Emissions when Supplied at 4 kV to 35 kV:

- ES55 Q4-04 MV Emission Limits — Rapid Voltage Changes;
- ES55 Q4-05 MV Emission Limits — Voltage Flicker;
- ES55 Q4-07 MV Emission Limits — Voltage Unbalance, and
- ES55 Q4-09 MV Emission Limits — Current Harmonics

Primary customers operating below 0.9 power factor may be subject to additional penalties. Customers should not operate with leading power factor.

3.7 Customer Service Entrance Equipment

BC Hydro accepts the following customer-owned utility type or CSA certified service main:

a) Utility type ganged pole-mounted load-break switch and fuses on the first customer pole;

b) Utility type ganged pole-mounted load-break switch and utility type recloser on the second pole;

c) Ganged load-break switch and fuses inside the customer's primary service switchgear;

d) Fixed breaker with an isolation switch inside the customer's primary service switchgear;

e) Draw-out type breakers with lock-out and grounding provisions;

f) Vacuum type or SF6 insulated switches, interrupters and breakers – indoor and outdoor, and

g) Live-front or dead-front type equipment.

For overhead line primary services, the customer shall install surge arresters in close proximity to the load side of the pole-top loadbreak switch, i.e. the opposite side of the H-Frame overhead span. However, for those services with primary revenue metering, surge arresters shall be installed on the metering pole for the most effective protection of the revenue metering cluster — see Appendix 2 ES43 J7-01 standard.

For underground primary services that have primary revenue metering, the customer shall install surge arresters on the load side of the service switch. For services with secondary revenue metering, surge arresters may be installed inside the customer-owned transformer enclosure as per attached drawing PG A1-01.

Note 9: For overcurrent protection and coordination requirements refer to Section 10.

3.8 Primary Service Voltage Conversion Requirements and Procedure

BC Hydro is continuously upgrading and expanding the power distribution grid, for improved service reliability and to meet the growing demand for electrical energy. Accordingly, various BC Hydro feeders are being upgraded from 12.5 kV to 25 kV, which may require existing customers to upgrade their customer-owned primary service equipment.

Primary service voltage conversion is a major undertaking, and BC Hydro will provide advance notification of the proposed conversion (a minimum six months in advance) to all primary customers affected by the proposed upgrade, to allow adequate time for design and construction for the customer service upgrade. To complete the conversion, BC Hydro shall schedule and coordinate the power outage, and the notice shall clearly state the date and time and duration of the scheduled power outage for the planned conversion.

All primary customer-owned primary service equipment shall meet the requirements for higher primary supply voltage, and increased fault level, overcurrent protection, potential rise of ground grid and step-and-touch voltage requirements per CEC Part I Section 36. Therefore, the customer shall follow all steps and obtain the necessary electrical permits, inspections and approvals described in Section 5.0 of this guide. For new services where the customer-owned primary service equipment is initially operated at 12 kV, the equipment manufacturer shall supply a certified 12 kV to 25 kV conversion kit, containing all components required for conversion to 25 kV. This conversion kit shall be kept stored in a pouch inside the switchgear or in a cabinet mounted on the wall inside the HV primary vault.

3.9 Customer-Owned Standby Generation

Customer-owned generation is classified as open-transition standby (break before make) or closed transition (make before break) generation.

3.9.1 Open-Transition Standby Generation

The customer may operate a standby generator, at primary or secondary voltage, as an emergency power supply, independent and disconnected from the BC Hydro service – open transition. The generator must not, under any circumstances, operate in parallel with the BC Hydro service.

For a primary voltage manually-operated open-transition standby generator with mechanical key interlocks, such as in shopping malls or institutions, BC Hydro requires a Distribution Operating Order for

the safety isolation and disconnection of the BC Hydro utility supply. Furthermore, all interlock schemes which include locking out the BC Hydro primary supply shall be reviewed and accepted by BC Hydro. Mechanical key interlocked devices shall be operated by qualified personnel only.

For primary voltage service with a manually-operated open-transition secondary voltage standby generator using a fabricated integral transfer switch, BC Hydro shall review and accept only a CSA certified manually-operated utility supply transfer switch.

For primary voltage service with an automatically-operated open-transition secondary voltage standby generator using a fabricated integral transfer switch, BC Hydro shall review and accept only a CSA certified automatically-operated utility supply transfer switch.

For secondary voltage customers with an open transition standby generator, BC Hydro has transferred all verifications of compliance and installation of customer-owned open transition transfer switches to the TSBC (formerly BCSA) and the electrical Authority Having Jurisdiction. However, BC Hydro will only accept CSA-certified utility transfer switches specifically built for this function, per the applicable CSA 22.2 standards. BC Hydro will not accept any custom-built mechanical or electrical interlock schemes replicating the function of a CSA-certified utility supply transfer switch.

3.9.2 Closed Transition Standby Generation

The customer may operate standby generation in parallel with the BC Hydro supply for up to 20 seconds in a closed transition transfer (CTT); however, such operation shall be reviewed and accepted by BC Hydro. Customers may not operate generation in parallel with BC Hydro, for any reason, without written approval from BC Hydro. Refer to the BC Hydro Distribution Generator Interconnections website for application forms, generator interconnection requirements, and the process for receiving written approval.

The requirements for closed transition transfer can be found in the “Interconnection Requirements for Closed Transition Transfer of Standby Generations”, which can be found on the BC Hydro website.

For further information on the CTT process and requirements, refer to BC Hydro Distribution Generator Interconnections on the BC Hydro web site at https://www.bchydro.com/accounts-billing/electrical-connections/distribution-generator-interconnections.html

3.10 Maintenance and Testing

The customer is responsible for regular maintenance and testing of the customer-owned primary service equipment in accordance with the manufacturer’s recommendations. In general, a BC Hydro crew does not operate customer-owned equipment. Protective relay settings and operation, as applicable, and circuit breaker operation shall be set and tested by the customer and accepted by BC Hydro before energization. However, BC Hydro reserves the right to inspect and test the system at any time, and to request any necessary maintenance. This inspection shall not relieve the customer of any or all responsibility for maintenance of the equipment.

For existing dual radial supply customers, WorkSafe BC and BC Hydro safety rules require customers who own or manage dual radial vaults to perform maintenance on the switches of the running and standby circuits every 42 months (3.5 years). BC Hydro provides two to three maintenance windows each year to help customers maintain their vault in a timely manner. The customer is required to conduct maintenance to avoid becoming non-compliant. When maintenance occurs, the HV contractor shall de-energize the vault, in coordination with the BC Hydro crew, take the equipment apart, clean the

components, test the equipment and restore the supply service. Maintenance is booked within BC Hydro pre-determined windows of time, but all work is carried out by the customer at the customer's expense.

For further information on dual radial maintenance requests, refer to Appendix 2.

The customer HV primary service vault is designated for restricted access only to qualified personnel, according to WorkSafeBC Part 19. Furthermore, the HV primary service vault shall not be used as a storage room, obstructing access to the HV equipment. These requirements are explicitly stated in the BC Fire Code Regulation, Canadian Electrical Code and WCB Regulation. For further information, refer to the "No Storage Allowed" sign in Appendix 2.

3.11 Customer Application Process

The customer primary service application and connection procedure is laid out in a flowchart shown in Appendix 2. It is important to note that, for speedy processing of the application, it would be most efficient for the customer to follow the attached flowchart.

4 Standards and Regulations

Notwithstanding the requirements set out in the previous section, requirements for primary services contained in this "Primary Guide" are in addition to the latest revisions of applicable standards and regulations by the regulatory Authorities Having Jurisdiction at the site:

- BC Safety Authority – Safety Standards Act;
- BC Safety Authority – Electrical Safety Regulation;
- BC Safety Authority – Directive No: D-E3 090313 1 High Voltage Installations;
- BC Safety Authority – Directive No: D-E3 070801 7 Electrical Operating Permit Requirements;
- https://www.worksafebc.com/en/law-policy/occupational-health-safety/searchable-ohs-regulation/ohs-regulation/part-19-electrical-safety;
- Canadian Electrical Code C22.1 — safety standards for electrical installations;
- BC Hydro Distribution Standards;
- BC Hydro Advisory 2016-016: Transfer Switches for Emergency Standby Generators;
- BC Hydro Advisory 2017-002: Customer Power Quality Emission Limits for Low and Medium Voltage;
- BC Hydro Safety Practice Regulations;
- BC Hydro Electric Tariff;
- BC Hydro Requirements for Manually Read Primary Service Voltage Revenue Metering (4kV to 35kV);
- Engineers and Geoscientists Act of BC;
- Ministry of Energy and Mines of BC; PO Box 9320 Victoria Tel. 250-952-0793;
- CSA C22.2 No. 31 Switchgear Assemblies;
- CSA22.3 N0. 1-15 Overhead Systems;
- CSA22.3 No. 7-15 Underground Systems;
- CSA22.2 N0. 41-13 Grounding and Bonding Equipment, and
- IEEE80-2013 Guide for Safety in AC Substation Grounding.

5 Submission Procedure

5.1 Preliminary Design

When applying for a primary voltage electrical service connection, or alterations or upgrades to the existing primary services, which requires an electrical permit per TSBC (formerly BCSA) regulations, the customer or the consultant shall, at the preliminary stage of planning, contact the nearest BC Hydro office and provide the following information to the BC Hydro designer:

5.1.1 Customer Submissions

The customer must supply to BC Hydro the total connected load and nature of the load, including a list of:

1) Motors 50 HP and larger in 12.5 kV areas and motors 100 HP and larger in 25 kV areas, which may require inrush current mitigation;
2) Harmonic current generating loads such as solid-state drives, rectifiers, uninterruptible power supply (UPS), high-efficiency lighting etc;
3) Flicker generating loads such as arc furnaces, chippers, crushers, etc;
4) Preferred service type, overhead or underground;
5) Estimated maximum demand;
6) Emergency standby generators as applicable;
7) Service address, and
8) Planned in-service date.

5.1.2 BC Hydro Response

The BC Hydro designer will, in return, supply the customer with the following information:

1) Primary supply voltage — all new primary service equipment shall be rated and certified for operation at 14.4 or 25 kV supply;
2) Service type overhead, underground, radial, or dual supply;
3) System impedance and available fault levels at the service point of connection;
4) BC Hydro terminal pole, switchgear kiosk, size of fuses or BC Hydro substation feeder relay settings;
5) Expected future supply changes for which the provision shall be included;
6) Details of the BC Hydro Electric Service Agreement;
7) Status of the available capacity to supply proposed new load from the existing distribution feeder, demand limits, rapid voltage change limits, flicker emission limits, harmonic current limits, etc., and
8) Designated space and registered statutory right of way on private property for installation of BC Hydro-owned equipment associated with the primary service.

In addition to the above exchange of information, we recommend our customers visit the BC Hydro website for further resources.

BC Hydro website: www.bchydro.com

Get Connected: www.bchydro.com/getconnected/

Revenue Metering: http://www.bchydro.com/distributionstandards

Power Smart: www.bchydro.com/business/

5.2 Formal Application

The formal application for a new primary service connection, or alteration of the existing primary service, shall include the following documents and drawings certified by a professional engineer:

1) An electrical one-line diagram including calculated fault levels, interrupting rating of protective devices and emergency stand-by generation, per paragraph 5.2.1;
2) A protective device coordination graph showing coordination between the customer and BC Hydro protective devices, per paragraph 5.2.2;
3) A site plan, with equipment and primary vault locations, statutory rights-of-way, minimum clearances from the building and primary conduit run as applicable, per paragraph 5.2.3;
4) An overhead line design showing the first customer pole and pole class, service switch and safety mat, fused cutouts and conductor separation at the crossarm, phase conductors and neutral separation in compliance with the CSA22.3 No.1 standards, per paragraph 5.2.4;
5) A primary service equipment drawing, including the load-break switch or circuit breaker, control wiring diagram and key interlock scheme, if applicable. If such manufacturer drawings are not available, a BC Hydro designer may complete the review of an incomplete application. However, BC Hydro shall not issue an authorization for connection of the customer primary service without acceptance of the primary service equipment fabrication drawings as outlined in paragraph 5.3, and
6) A completed BC Hydro form entitled “Statement to BC Hydro Regarding Primary Voltage Service Entrance Equipment”, per paragraph 5.2.5 (see Appendix 2).

Note 10: An incomplete application, or the lack of formal declarations, may delay the date of service to the customer. In general, a BC Hydro designer will process the formal application and respond to the customer within four weeks after submission.

Note 11: All liability for design and installation of customer-owned primary service equipment and materials rests with the customer’s Professional Engineer and Licensed Electrical Contractor.

5.2.1 Electrical One-Line Diagram

See sample drawings PG A1-01 and PG A2-01.

The electrical one-line diagram shall be certified by a Professional Engineer, showing the connection of all service entrance equipment and emergency stand-by generators, as applicable. In addition, the one-line diagram shall clearly show the cable and conductor sizes, available fault levels and interrupting rating of the overcurrent protection devices, proposed service fuse ratings or proposed relay settings, etc. The

one-line diagram shall serve as a supplement to the Primary Service Declaration document described in paragraph 5.2.5. For BC Hydro primary service cable sizes, see the attached BC Hydro drawings PG C1-03.

With regards to customer-owned emergency standby generation, BC Hydro requires the following information:

1) Rating, make and model of the emergency standby generator and the associated break-before-make transfer switch, and a copy of the certificate of CSA approval, or equivalent;
2) Completed application form and required details for any closed transition transfer (make-before-break or bumpless transfer) type of automatic transfer switches per CEC Section 84, for review and approval by BC Hydro Distributed Generator Interconnections , and
3) A copy of the Certificate of Final Inspection by the TSBC (formerly BCSA) after completion of installation, which certifies that all electrical equipment was installed in accordance with the applicable codes and local bylaws.

For further information, see https://www.bchydro.com/content/dam/BCHydro/customer-portal/documents/distribution/standards/ds-dgi-requirements.pdf?accept=accepted

Note 12: In the event of any malfunction or improper installation of a customer-owned transfer switch and/or stand-by generator, the owner is responsible for any damage to the BC Hydro revenue metering equipment and to the service connection.

5.2.2 Protective Device Coordination Graph

Refer to sample drawings PG D1-01. The customer should submit Professional Engineer-certified Time-Current Characteristic (TCC) curves showing:

1) A single TCC curve with feeder protection, customer relay/fuse curves, and transformer inrush;
2) Indicated time margins between the BC Hydro protection and customer entrance protection — see Section 10.1.4 for the minimum time margins requirement;
3) Indicated maximum fault levels for three-phase faults and single line-to-ground faults (SLG), but without cutting the curves at those points;
4) Each curve having a corresponding text box providing details of the curve (relay manufacturer, pickup, time dial, CT ratio and delay), and
5) A standard sized 4-½ x 5 cycle log-log graph used for the coordination study. It is mandatory that the customer's service entrance protective device setting be compatible and coordinate with BC Hydro's protective equipment. For further information regarding protection requirements, refer to Section 10.

Note 13: For complex or illegible coordination graphs, BC Hydro may request the customer to submit the graph on an 11"×17" sheet instead of a regular 8-½"×11" sheet.

5.2.3 Site Plan

The site plan shall show all details of the primary service installation, civil and electrical, overhead or underground plant. In particular, the plan shall show the location of the building and the primary service vault, the proposed terminal pole or service manhole, and routing of the aerial line or underground cables

on private property (inside the customer building) to the customer primary service. For detailed information and BC Hydro requirements, refer to Section 7 - Scope of Supply for Primary Services**.**

Figure 1 — BC Hydro U/G Duct Marker Board

Note 14: The BC Hydro designer may request the customer to install the above cable marker boards (12 x 450 x 1000 mm) for some portion of the underground service duct run on private property with a high risk of future potential damage from dig-ins.

To expedite project approval, BC Hydro requires the customer or his consultant to show a detailed design of a primary vault or an outdoor kiosk, with crew access and emergency escape routes, minimum operating clearances, safety grounding, proposed primary service duct layout, bends, fittings and pull boxes as applicable. See Section 8 for further details about underground service requirements.

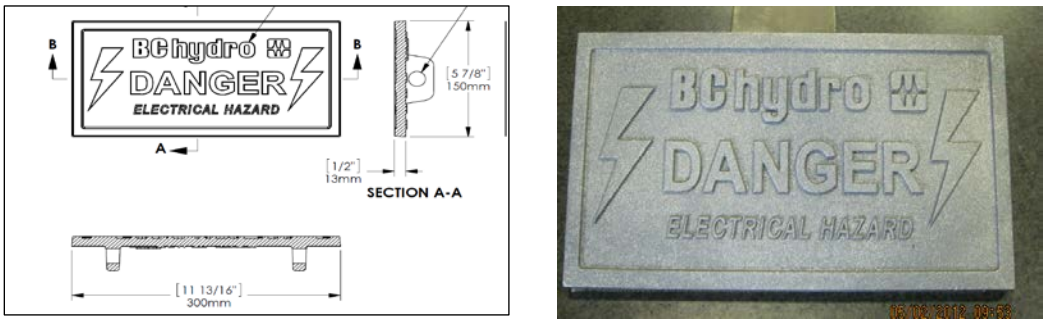


Figure 2 — BC Hydro Primary Cable Warning Plate

Note 15: The BC Hydro designer may request the customer to install the above permanent cast iron warning plates for that portion of the primary service ducts embedded inside the customer concrete building walls, floor slabs or parkades. Warning plates are stipulated by BC Electrical Code Rule 36-100 (4) and placed at intervals of not more than 3 m. Cast iron warning plates are supplied by BC Hydro and are included as part of the primary service connection costs.

5.2.4 Primary Service Overhead Line Construction Details

The customer shall submit engineered drawings showing the construction details of a privately-owned overhead line for acceptance by BC Hydro before constructing the line. Engineered drawings shall include the following minimum design details per the CSA22.3 No. 1 standards:

1) First customer pole, self-supporting, double dead-ended, crossarms and Gang Operated, Load-Break Switch (GOLB) service switch and fused cutouts;
2) Gradient control mat, ground electrodes and switch grounding details;
3) Conductor separation at the crossarm, phase conductors and neutral separation, neutral conductor attachment separation to ground;
4) Fused cutouts (or recloser) mounting details and minimum clearances between devices on the pole, and
5) Pole class and minimum height of each pole.

To avoid costly project delays and field modifications of the customer-owned overhead line, a customer shall not commence the construction until all drawings and information have been reviewed and accepted by a BC Hydro designer within four weeks from the date of receipt. For a visual reference of overhead line construction examples, see the attached pictures in Appendix 3.

5.2.5 Primary Service Declaration

Refer to the attached sample in Appendix 2.

The form entitled “Statement to BC Hydro Regarding Primary Voltage Service Entrance Equipment” (“Primary Service Declaration”) shall be fully and properly completed to provide information about the customer-owned primary service equipment. This form shall be signed and sealed by a registered Professional Engineer in good standing with APEGBC. For a free copy of the BC Hydro Primary Service Declaration, please contact your local BC Hydro design office or visit the BC Hydro website at: http://www.bchydro.com/youraccount/content/electrical_connections.jsp

5.3 Primary Service Fabrication Drawings Acceptance

The customer shall submit certified for fabrication drawings for a proposed primary service switchboard or drawings for a proposed primary services kiosk to BC Hydro for comments and acceptance, prior to manufacturing. The BC Hydro designer will issue a response letter with the referenced drawings, and return them to the customer with applicable comments and a confirmation of acceptance.

To avoid costly changes and field modifications of the customer-owned equipment, no manufacture of the equipment should commence until all drawings and information have been reviewed and accepted by a BC Hydro designer within four weeks from the date of receipt.

BC Hydro is particularly concerned about safety to the public and the service crew. Therefore, the customer-owned primary service equipment shall be designed, manufactured and installed to meet all pertinent regulations including those of:

1) WorkSafe BC regarding safe working space, operating access and electrical clearances;

2) BC Hydro Safety Practice Regulations for grounding details, limits of approach and barriers for energized conductors, and interlock schemes and lockout provisions, and

3) CSA, CEC, TSBC (formerly BCSA) and local inspection authorities.

Note 16: Each cell, cubicle or compartment of the primary service switchboard, as well as the service cable pull boxes, which are for the exclusive use of, and have restricted access to, BC Hydro personnel, shall be equipped with a padlocking hasp, or BC Hydro proprietary security bolts, or other security restraining means with sealing provisions.

The primary service switchboard or kiosk drawing shall show the following:

1) Fully dimensioned switchboard cells and details, access doors and locking provisions;

2) Ground bus layout, equipment grounding pads and personnel safety ground balls;

3) Primary service cable compartment and cable termination provisions — see the attached standards ES54 S3-01, S3-02 and S3-03 in Appendix 2;

4) A main switch or a breaker switchboard cell;

5) A wiring diagram of the circuit breaker and protective relaying, as applicable;

6) An interlocking diagram, equipment nameplates and “HIGH VOLTAGE” and warning signs, and

7) A primary or secondary revenue metering compartment or switchboard cell.

For further design and installation details, please contact your BC Hydro designer, and review the BC Hydro Distribution Standards and other sections of this Primary Guide.

5.4 HV Commissioning Report and Authorization for Connection

Prior to the final BC Hydro inspection for an authorization of connection, BC Hydro shall receive an HV Commissioning Report certified by a Professional Engineer, containing the following information:

1) A protective relaying study;

2) A fault coordination study;

3) A Grid Potential Rise (GPR) step and touch grounding report, per BCEC Part I, Section 36;

4) A service switch or breaker test report;

5) A protective relaying test report;

6) A transformer production and commissioning test report for unitized substations, including an oil analysis report, if applicable;

7) A high voltage cable test report for service connections involving customer installed cables, if applicable;

8) “As constructed” engineering drawings;

9) A copy of the Final Inspection Certificate from the inspection Authority Having Jurisdiction of the site, and

10) A contractor declaration, as attached in Appendix 2, stating that the primary service is completed in compliance with BC Hydro requirements and the BC Electrical Code.

Note 17: For installation of **used** equipment in customer-owned primary services, the customer shall provide a copy of certified test results, reviewed by a Professional Engineer, to certify that the proposed equipment has been tested and it is suitable for connection to the BC Hydro distribution system.

5.5 Primary Service Voltage Conversion Requirements and Procedure

Refer to Section 3.8.

5.6 Dead-Front Primary Services

Refer to the ES54 S3-01 and ES54 S3-03 standards and the attached pictures in Appendix 3.

BC Hydro continues to improve the safety of primary service connections by field evaluation and acceptance of the dead-front switchgear outdoor type kiosk for customer-owned primary services. Eaton Corporation equipment received BC Hydro's acceptance in 2016, and three additional manufacturers are currently being evaluated by BC Hydro for acceptance of their equipment design.

Dead-front equipment is consistent with BC Hydro Work Methods and provides an additional safety barrier. BC Hydro's long-term goal is to phase-out live-front outdoor type customer-owned primary service equipment.

The following checklist shall serve as a guide for BC Hydro designers for the review and acceptance of dead-front customer-owned primary service:

1) The outdoor type service kiosk shall be a CSA-certified assembly installed on a customer-owned flat concrete pad with a cable duct window below the utility cable compartment —a cable pull pit below the utility compartment shall not be permitted;
2) The indoor type service switch shall comply with BCEC rules for the installation of oil-filled equipment. In addition, it shall have a remote shunt trip push button at a readily accessible location outside the room complete with hasp for a BC Hydro padlock only;
3) Primary 25 kV service supply cables shall be 4/0 AWG, 500 kcmil or 750 kcmil;
4) The customer shall supply and install an 832 box for 4/0 AWG cables and a 1232 box for 500 kcmil and 750 kcmil cables, located 3.0 metres approximately from the outdoor kiosk. Further separation may be acceptable with BC Hydro Field Manager approval. An 832 box shall be installed with one riser, but a 1232 box shall be installed with two risers;
5) The supply service cable compartment and the 832/1232 box shall be for restricted access by BC Hydro personnel only;
6) The fluid-filled service switch shall be mechanically interlocked with the interrupter or breaker;
7) The switch compartment shall be equipped with a double hasp for installing BC Hydro and customer locks independently;
8) The service switch shall have an integral grounding position, configured so as to allow grounding of the service bushings. The switch shall be lockable in the grounding position using a BC Hydro padlock. It shall also be possible to block the switch from being placed in the grounding position using a BC Hydro padlock;

9) The service switch shall allow locking in the open position using a BC Hydro padlock;

10) The viewing window specific to the dead-front service switch shall facilitate clear visibility of contact positions for BC Hydro crew to positively determine the switch status and contact positions;

11) The service switch shall be operable using a 2.0 m long hook stick, integral operating handle or detachable operating handle stored within the switch compartment;

12) The service bushings shall be 900 A deadbreak interface, 25 kV class, and meet the requirements of IEEE standard 386-2016;

13) A capacitive voltage indicator shall be installed between each service bushing and the service switch, to indicate the presence of voltage at the service bushing, and

14) Relaying transformers may be connected to the line side and surge arrestors on the load side of the mechanically interlocked service switch/interrupter assembly.

5.7 Temporary Power as Primary Service

All primary customer-owned primary services shall meet the requirements for BC Hydro primary distribution supply voltage and available fault level, overcurrent protection, potential rise of ground grid and step-and-touch voltage requirements per CEC Part I Section 36. Therefore, a customer applying for connection of temporary primary service shall follow all steps and obtain the necessary electrical permits, inspections and approvals described in Section 5.

Note 18: A temporary service shall meet all requirements of this guide applicable to permanent primary services.

6 BC Hydro Primary Distribution System

6.1 Preliminary Design

All BC Hydro primary service connections are fed from the BC Hydro primary voltage distribution system, comprising a three-phase, four-wire, multi-grounded common neutral system. The primary distribution voltages are:

1) 2,400 V / 4,160 V Grounded Wye (currently being phased out);
2) 7,200 V / 12,470 V Grounded Wye;
3) 14,400 V / 24,940 V Grounded Wye, and
4) 19,920 V / 34,500 V Grounded Wye (currently used only in some rural applications in the Central Interior area of the Northern Region).

System frequency is at 60Hz $\pm$ 0.1Hz. Primary voltages may be designated in this guide by their nearest whole number; e.g., a nominal voltage of 25 kV means 14,400 V/24,490 V Grounded Wye.

BC Hydro will determine the voltage of the customer's service. BC Hydro will normally supply a service at a secondary voltage and size as listed in the following section. If the customer requires a larger service, or service at a different voltage, or if it is not feasible for BC Hydro to install the equipment required for a secondary service, then a primary service will be offered. The customer shall contact the BC Hydro designer to determine what voltage they will be served at **before** designing the electrical room and the purchase of equipment.

The following are the maximum customer service switch sizes, rated for 80 percent continuous operation, to be supplied by BC Hydro at the secondary distribution voltage in areas where the primary service voltage is either 12 kV or 25 kV:

Overhead

- 600 A at 1Ø 3-wire 120/240 V, 80 percent rated main switch;
- 400 A at 3Ø 4-wire 347/600 V, 80 percent rated main switch, and
- 800 A at 3Ø 4-wire 120/208 V, 80 percent rated main switch.

Underground

In areas where the primary service voltage currently is 12 kV (may include areas that are 'Designated as 25 kV'):

- 600 A at 1Ø 3-wire 120/240 V, 80 percent rated main switch;
- 1600 A at 3Ø 4-wire 120/208 V, 80 percent rated main switch, and
- 600 A at 3Ø 4-wire 347/600 V, 80 percent rated main switch.

In areas where the primary service voltage is 25 kV:

- 600 A at 1Ø 3-wire 120/240 V, 80 percent rated main switch;
- 1600 A at 3Ø 4-wire 120/208 V, 80 percent rated main switch, and

- 1600 A at 3Ø 4-wire 347/600 V, 80 percent rated main switch.

In some rural applications where the primary service voltage is 19,920 V/34,500 V Grounded Wye, the maximum consumer service switch sizes, rated for 80 percent continuous operation, to be supplied by BC Hydro at the secondary distribution voltage are:

- 600 A at 1Ø 3-wire 120/240 V, 80 percent rated main switch;
- 1600 A at 3Ø 3-wire 120/208 V, 80 percent rated main switch, and
- 600 A at 3Ø 4-wire 347/600V, 80 percent rated main switch.

For further details and 100 percent rated services and main switches, please contact the BC Hydro designer.

6.2 Supply of Service Transformers

For secondary voltage service, BC Hydro will supply and install the necessary transformers. For primary voltage service, the customer will supply and install customer-owned transformers as required. The exception could be for overhead primary services, usually in rural or industrial areas, where BC Hydro may supply standard overhead transformers up to 167 kVA per phase, if requested by the customer.

Note 19: Parallel connection of BC Hydro transformers is not permitted.

6.2.1 Primary Service Transformer Connections

The customer-owned transformer connections accepted by BC Hydro are:

1) Grounded Wye - Grounded Wye. Primary and secondary transformer neutrals shall be connected, solidly grounded to the station ground and connected directly to the BC Hydro service system neutral, to minimize the neutral voltage rise caused by the load imbalance. This is the BC Hydro preferred connection for better ground fault protection and safety of operating personnel.
2) Delta - Grounded Wye. This connection is a common connection for factory-built unit substations with dry-type transformers and a solidly grounded wye point. Ferroresonance could be a problem, as with all ungrounded primary transformer connections, wherein voltage feedback will occur when one primary phase opens.
3) Delta - Resistance Grounded Wye. This connection is preferred for limiting the damage to sensitive electronic equipment caused by line-to-ground faults. Also,, mission critical production machinery would be able to continue to operate in the presence of a line-to-ground fault until a planned shutdown. In this configuration, secondary windings are relatively disconnected from the station ground, and large service transformers could exhibit similar types of problems, such as overvoltage feedback from the primary side and ferroresonance, if any one primary phase would open circuit.
4) Ungrounded Wye - Delta. The transformer primary neutral is floating and insulated to the service potential to avoid over-voltage feedback and single-phasing problems. Each single-phase transformer requires two primary bushings, and primary voltage could be present on this floating neutral under certain conditions, for example one phase open caused by a blown primary fuse.
5) Delta - Delta. Two-bushing transformers are required for a three-phase bank of single-phase transformers. If one phase of the primary line opens, a backfeed voltage approximately equal to one-

half line-to-line voltage will be impressed on the open phase. Ferroresonance may result, as with all ungrounded primary connections.

Notwithstanding, BC Hydro strongly recommends the customer to seek the advice of a Professional Engineer regarding the type of transformer connection to suit the plant operation, specific load requirements and ground fault protection scheme.

6.2.2 Service Neutral Connections

BC Hydro requires a 3" × ¼" (76.2 × 6.4 mm) copper bus for terminating the neutral conductor, metallic cable shield and/or concentric neutral conductors. For the drilling pattern and spacing, refer to the ES54 S3 standards. Use 50 mm minimum spacing from the back panel for installation of threaded fasteners.

Regardless of the power transformer primary connection, the BC Hydro service neutral will be terminated at the customer's grounded neutral bus to maintain primary ground fault continuity.

Where primary voltage revenue metering is installed, the customer's neutral shall be insulated, single point bonded and extended to:

a) the pole-mounted metering kit, for overhead line construction with a pole top metering kit, or

b) the revenue metering instrument transformer compartment, if primary switchgear is used.

For further information, please refer to the BC Hydro document *Requirements for Manually Read Primary Service Voltage Revenue Metering (4 kV to 35 kV)*, available from the BC Hydro web site at http://www.bchydro.com/distributionstandards

6.2.3 Transformer Taps

BC Hydro recommends that customer-owned transformers use industry-standard 2 x 2.5 percent primary taps above and below rated voltage. The BC Hydro system operates within the voltage range specified in CSA Standard C235-83. The use of taps on the customer's transformer will allow the customer to adjust the voltage, as required, at the point of utilization.

6.2.4 Maximum Transformer Size and In-Rush Current Limitation

Customer-owned transformer in-rush current levels shall coordinate, during the energization transition period, with the BC Hydro upstream protective device (recloser, fuse or relay) and meet the customer emissions limits – refer to paragraph 3.6.5 above.

7 Scope of Supply for Primary Services

7.1 BC Hydro Scope of Supply for Overhead Service Connection

For a primary overhead service connection, BC Hydro normally supplies and installs the following:

1) Fused cutouts on the supply end of the primary service connection.
2) Fused links for overcurrent protection of the BC Hydro primary service conductors.
3) Solid links and BC Hydro feeder protective relaying for large primary services.

   Note 20: For improved service reliability for all customers, the BC Hydro feeder planner could order the installation of a dedicated recloser and request the customer to co-ordinate the new customer primary service protection relays with the BC Hydro dedicated recloser relays.

4) Primary overhead service conductors and the primary service connection to the customer-owned loadbreak switch located on the first customer-owned pole.

   Note 21: Location of the first customer-owned pole, as the point of delivery, shall be selected in agreement with BC Hydro. Thereafter, the pole lines on private property, pole dip, customer-owned unit substations, etc., are installed, owned and maintained by the customer under the jurisdiction of the TSBC (formerly BCSA) or other Authority Having Jurisdiction.

BC Hydro requirements on private property extend to the installation of primary or secondary revenue metering, which shall comply with BC Hydro metering requirements listed on the BC Hydro web site at http://www.bchydro.com/distributionstandards and Section 6 of this guide.

BC Hydro supplies the following equipment for installation by the customer's licensed electrical contractor:

a) An outdoor-type primary revenue metering cluster, complete with a pole mounting bracket and a revenue metering cabinet for primary revenue metering, or
b) Switchgear-type secondary revenue metering transformers and an indoor revenue metering cabinet for secondary revenue metering.

   Note 22: A pole-mounted overhead type primary revenue metering kit is a costly option, which shall be charged to the customer as a cost of service connection. BC Hydro prefers secondary revenue metering, which is much less costly and requires less maintenance.

7.2 Customer Scope of Supply for Overhead Service Connections

For primary overhead services with pole-mounted primary revenue metering, BC Hydro requires the customer to install the following materials and equipment:

1) A load-break switch and safety ground mat on the first pole per PG A1-01 drawing and TSBC (formerly BCSA) rules.

   TSBC (formerly BCSA) Directive D-E3 090313 1 paragraph 15 states that the load-break switch shall be a utility type rated for 600 A continuous current and 22 kA fault closing.

Note 23: BC Safety Authority inspectors do not require a certified grounding report for the safety ground mat at the first customer-owned pole load-break switch.

2) All customer-owned ungrounded service conductors shall have overcurrent protection by means of fuses or a circuit breaker, per CEC Part 1 Rule 36-204. A load-break switch requires fused cutouts on the first pole to meet the applicable rule.

   Note 24: An exception to the previous requirements in point 2 is where the customer chooses to install a utility type recloser as a means of customer-owned over-current protection. In this configuration, the recloser shall be installed on the second customer-owned pole and the BC Hydro primary metering kit shall be installed on the third customer-owned pole — refer to the PG A1-02 drawing.

3) The BC Hydro primary revenue metering kit, in general, shall be installed on the second customer-owned pole. To minimize the effect of transient switching surges and lightning strikes, the customer shall install the surge arresters, per the ES43 J7 standards in Appendix 2, near the primary revenue metering apparatus.

4) The safety ground mat on the second pole below the BC Hydro Revenue Metering Cabinet per BCEC Rule 36-310 and the BC Hydro standard ES43 R3-05 contained in Appendix 2.

7.3 BC Hydro Scope of Supply for Underground Building Service Connection

For a primary underground service connection, BC Hydro will supply and install the primary service cables (pulled inside the customer-owned cable ducts) and corresponding service cable terminators installed inside the utility service cable compartment of the customer-owned primary service switchboard, as the point of connection.

BC Hydro may install the following types of cable terminations:

1) Cable terminations for extruded dielectric cables.

2) In areas designated by BC Hydro for underground primary open loop service, BC Hydro will supply and install BC Hydro owned and operated automated switches (for loads not exceeding 6.5 MVA in a 7.2/12.5 kV area) or a junction box (for loads not exceeding 1.5 MVA in a 7.2/12.5 kV area). For further details, refer to the ES54 E6-01 standard in Appendix 2. For large customer loads, or a service requiring standby supply from another feeder, a service connection shall follow the ES54 E6-02 standard.

For primary underground services, BC Hydro will supply the following equipment for installation by the customer's Licenced Electrical Contractor:

a) Switchgear type primary revenue metering transformers and a revenue metering cabinet for the primary revenue metered service, or

b) Switchgear type secondary revenue metering transformers and a revenue metering box for the secondary revenue metered service.

BC Hydro requirements on private property extend to the installation of primary or secondary revenue metering, which shall comply with the BC Hydro metering requirements listed on the BC Hydro web site at http://www.bchydro.com/distributionstandards and Section 6 of this Primary Guide.

Note 25: All revenue metering equipment and necessary conduits shall be installed by the customer, whereas all control and interconnection wiring is supplied and installed by BC Hydro.

Upon receipt of the application for a new service, BC Hydro will, in consultation with the customer, determine the best available form of underground service, in accordance with a designated BC Hydro primary distribution system:

a) **Single Radial Supply** — comprising the incoming cable termination and a gang-operated disconnect or loadbreak switch, as per the attached drawing PG A1-01. The upper limit for the transformer size is limited by the upstream protection device to which the transformer shall coordinate – refer to Section 6.2.4.

b) **Primary Service Dual Supply** — comprising two radial supplies, as per the attached BC Hydro drawing PG A2-01. This configuration may be required for:

   i) High-reliability primary services with a standby feeder;

   ii) Large loads exceeding the limits stated in paragraph (a), in consultation with the BC Hydro designer, or

   iii) Other — customer special request (for example, dedicated standby supply).

The procedure for transferring customers from the normal feeder to the standby feeder involves momentarily paralleling both circuits in the customer's vault. For a detailed description of the switching procedure, please contact the BC Hydro designer.

7.4 Customer Scope of Supply for Indoor Primary Service Vaults

7.4.1 BC Hydro Supply Point Located Outside Customer Building

The customer shall supply and install the following:

1) A primary service vault for the slab-on-grade building located at the side or adjacent to the BC Hydro underground supply point – refer to the attached standard ES54 S3-03. For a “parkade” type building, the customer shall locate the primary service vault in agreement with the BC Hydro designer;

2) A primary service vault access door key for direct exterior access or direct access from a building parkade;

3) A cable pull pit (with pulling iron, removable cover plates and support beams, and drainage) located directly below the primary service switchboard – for further design details refer to the ES54 S3-03 standard in Appendix 2, ;

4) All cable ducts, conduits and fittings on the customer’s property;

5) Engineered structural supports for the service cable ducts and conduits;

6) Metal cable pull boxes with hinged cover doors equipped with penta bolts and padlocking hasp, as per the attached standards ES54 S3-01, S3-02 and S3-03 in Appendix 2, and

7) Primary Supply service cable compartment(s) with grounding balls and safety insulation barriers per Section 9.1.1, busbar or bushing phasing ABC, left to right.

7.4.2 BC Hydro Supply Point Located Inside Customer Building

For primary services requiring a BC Hydro switchroom inside the customer building, the customer shall construct an appropriately prepared electrical room as per the ES54 E6-01 or ES54 E6-02 standards.

As the BC Hydro supply point is located inside the customer building, the BC Hydro supply service cables shall run between the BC Hydro switchgear vault and the customer primary service vault. Therefore, these supply service cables shall be pre-cut outside the building by the BC Hydro crew and transported into the customer vault or BC Hydro vault for manual pulling installation. Because of the restricted height of 2.1 metres, BC Hydro can only deliver small cable reels, which limit the service cable length. Consequently, the customer primary service vault shall be located close to the BC Hydro switchgear vault and the maximum length of each supply service duct shall be less than 10 metres (33 ft.).

If a customer wants to locate a primary service vault more than 10 metres away from the BC Hydro switchgear vault, BC Hydro requires higher vehicle access clearance of 4 metres (12'-6") minimum to facilitate larger cable reel delivery vehicles.

7.5 Customer Scope of Supply for Outdoor Primary Service Kiosks

BC Hydro accepts a live-front and dead-front outdoor type primary service kiosk, although BC Hydro's long-term objective is to eliminate the live-front outdoor primary service kiosk for improved safety and reliability of service. To that extent, BC Hydro no longer accepts concrete cable pull-pits located below an outdoor primary service kiosk. Dead-front and live-front kiosks shall be installed in accordance with the ES54 S3-01 and ES54 S3-02 standards respectively — refer to Appendix 2.

Outdoor-type service kiosks shall be a CSA-certified assembly installed on a customer-owned flat concrete pad with a cable duct window below a utility cable compartment.

The customer shall supply and install the following:

1) A concrete pad for the primary service kiosk with conduit stubs located to align with the primary service cable compartment busbars;
2) An 832 Box for #1 AWG and 4/0 AWG cables, or a 1232 Box for 500 kcmil and 750 kcmil cables, located 3.0 metres approximately from the outdoor kiosk. Greater separation may be acceptable with the approval of the BC Hydro Field Manager. An 832 Box shall be installed with one riser, but a 1232 box shall be installed with two risers;
3) All primary service cable ducts located on the customer's property, and
4) Primary service cable compartment(s) with grounding ball studs and safety insulation barriers per Section 9.1.1, the busbar or bushing shall have a phasing arrangement of ABC left-to-right.

   Note 26: The power supply for auxiliary equipment inside the service kiosk, such as heaters, lights and convenience plugs, shall be connected after the revenue metering point. The customer is required to show this type of dedicated supply circuit on the one-line diagram.

7.6 Customer Scope of Supply for Primary Revenue Metering Kiosks

The customer, with BC Hydro's acceptance, may opt to install the primary service revenue metering kiosk, outside the customer's primary service vault or private overhead line, as a designated demarcation structure and a point of connection. This configuration may be suitable for distributed industrial plants with

multiple distribution transformers, or large strip malls, etc., or special installations requiring restricted access to BC Hydro personnel on private property.

A primary service metering kiosk includes all requirements and equipment listed in Section 7.4,1 above, with the addition of a primary revenue metering cubicle, as described in Section 3.5. In addition to other requirements, the revenue metering cubicle shall have a mechanical key interlock (with a primary service main on the line side and on the customer switch or a breaker on the load side as applicable) for safe access into the metering cubicle when the switches are locked out in the OFF position only.

8 Guidelines for Primary Service Construction

8.1 General

1) Customer-owned high-voltage installations shall comply with the applicable rules and regulations of the TSBC (formerly BCSA), BC Electrical Code and other regulatory Authorities Having Jurisdiction at the site. In addition, the CSA Standard C22.1 (CEC Part I) makes the following references:

   a) Rule 36-000, Scope, paragraph (2): "The supply authority and the Inspection Department shall be consulted before proceeding with any such installation";

   b) Rule 36-200, Service Equipment Location: “Service equipment shall be installed in a location that is in compliance with the requirements of the supply authority and, in the case of a building, shall be the point of service entrance”;

   c) Rule 36-202, Rating and Capacity, paragraph (b): “The type and rating of circuit breakers, fuses and switches, including the trip settings of circuit breakers and interrupting capacity of overcurrent devices, shall be in compliance with the requirements of the supply authority for the consumer’s service equipment”, and

   d) Rule 84-002, “The interconnection arrangements shall be in accordance with the requirements of the supply authority”.

Notwithstanding the above, all BC Hydro primary distribution systems are engineered and constructed in accordance with the certified BC Hydro Distribution Standards pertinent to BC Hydro as a self-regulating utility. Therefore, all customer-owned primary services connected directly to the BC Hydro distribution system shall be engineered and certified to be compatible with this system. The certification shall include all electrical equipment, support structures and the method of primary service connection, as well as service isolation, to ensure public safety and the safety of BC Hydro personnel. Consequently, customer-owned primary installations shall be installed by a Class A licensed electrical contractor, registered and licensed by the TSBC (formerly BCSA).

Note 27: If customer-owned equipment poses a safety or operational issue to the BC Hydro distribution system, BC Hydro may disconnect that primary service until the issue has been resolved.

For more information, contact the BC Hydro designer for the service area.

8.2 Underground Service Cables and Overhead Service Conductors

BC Hydro will supply and install all primary service cables, including all cable terminations, from the BC Hydro system to the customer point of connection. All new BC Hydro primary supply service cables are extruded dielectric cables.

BC Hydro shall determine the number and size of cables and conduits, based on the information received about the load profile and size of the primary service. For detailed information about overhead conductors, underground cables and installation costs, please contact the BC Hydro designer.

8.2.1 Cable Protection

Service cable runs on private property shall be kept to a minimum to reduce the possibility of cable damage and to supply subsequent disturbance to other services fed from that same circuit.

Primary service cables shall be adequately supported and protected from mechanical damage at all times. Cables located on walls inside a vault shall be protected either by suitable metal covers or metal bollards. All exposed cable pits shall be covered by aluminum checker plates, as shown in the attached standard ES54 S3-03 in Appendix 2. All plates shall be sized and located for easy removal, taking into account weight restrictions. In addition, each plate shall be bolted down for safety and shall restrict access to unauthorized persons.

A solid concrete barrier is required through the full length of the BC Hydro cables to separate the BC Hydro service and customer distribution cables, if both sets of cables are in the same cable pit.

8.2.2 Cable Termination

As stated in section 7.2, BC Hydro will supply and install the following types of supply service cable terminations:

a) Termination kits for extruded dielectric cables, for live-front equipment, or

b) Separable insulated connectors per the ES54 S3-01 standard in Appendix 2.

Note 28: All supply service cables shall enter the primary supply service cable compartment from the bottom and all cable terminations shall be installed and secured in the upright position. BC Hydro will not accept inverted cable connections or inverted cable terminations.

8.2.2.1 Cable Terminations for Extruded Dielectric Supply Service Cables

The supply service cable compartment shall have a 1-⅝"×1-⅝" C-channel located as shown on the ES54 S3-01, S3-02 and S3-03 standards for the attachment of BC Hydro supplied and installed cable supports used for short circuit bracing and mechanical support of the supply service cables. The supply service cable compartment shall be designed and constructed in accordance with the attached standards ES54 S3-01, S3-02 and S3-03.

Note 29: The customer shall contact the BC Hydro designer regarding the design and spacing of the incoming service cable compartment. BC Hydro's prevailing standard is to install 25 kV rated service cables, and the service cable compartment shall be suitable for longer cable terminations.

To ensure safety for limits of approach, the customer shall install removable insulation protective boots, as described in paragraph 9.1.1.

8.2.2.2 Separable Insulated Connectors for Dead-Front Services

The service bushings shall be 900 A deadbreak interfaces, 25 kV class, meeting the requirements of IEEE standard 386-2016. BC Hydro will supply and install T-body connectors, complete with copper stud, lug and insulating plug to connect supply service cables to the service bushings.

The supply service cable compartment shall include a 1-⅝"×1-⅝" C-channel mounted above the centreline of the supply service cable conduit for support of the service cables. This cable support mounting shall be positioned in the upward or forward (outward) facing orientation. The orientation shall

be readily adjustable by the BC Hydro installer. The attachment surface of the mounting provision shall be nominally aligned with the centre of the service duct and shall be adjustable from this point ±65 mm minimum. The cable support fixtures shall be supplied by BC Hydro. The cable entrance compartment shall be designed and constructed in accordance with the ES54 S3-01 standard in Appendix 2.

8.2.3 Cable Support

The supply service cable compartment shall include a 1-⅝"×1-⅝" C-channel mounted above the centreline of the supply service cable duct(s) for support of the service cables positioned in the upward or forward (outward) facing orientation. The orientation shall be readily adjustable by the BC Hydro installer. The attachment surface of the mounting provision shall be aligned with the service duct and service bus/bushing and shall be adjustable from this point (+15 mm -75 mm) minimum. Cable support fixtures (cable clamps or cable positioning brackets) shall be supplied by BC Hydro. The cable entrance compartment shall be designed and constructed in accordance with the ES54 S3-01, S3-02 or S3-03 standards in Appendix 2, as applicable.

8.3 Service Ducts, Manholes, Pull Boxes and Pull Pits

All service conduits, manholes, pull boxes and/or pull pits on private property shall be installed by the customer in accordance with the latest editions of BC Hydro's ES54 BC Hydro Underground Civil Standards and BC Government regulations, with reference to the latest revision of the CSA Standard C22.3 No. 7 – Underground Systems.

For further design details, refer to the ES54 2016 Underground Civil Standards:

http://www.bchydro.com/distributionstandards

8.3.1 Joint Usage

BC Hydro primary supply service cables and third-party communication cables shall be installed in separate ducts maintaining the minimum separation clearance stipulated by the CSA22.3 No. 7 standards. However, a joint use of BC Hydro service ducts is acceptable to BC Hydro under the following conditions:

1) Adequate protection of the communication cables exists, i.e. cable insulation, duct bank construction, etc.;
2) The communication cables occupy separate and individual assigned ducts;
3) If BC Hydro allows a communication cable inner duct, it shall be installed inside the BC Hydro neutral duct only and shall not reside in the same duct as a supply service cable, and
4) BC Hydro must be contacted regarding construction and work practices for work inside BC Hydro infrastructure.

8.3.2 Drainage

The customer shall ensure a downward sloping grade towards drain locations and provide proper drainage to the underground service entrance conduits/ducts, including cable pits, within his property. BC

Hydro will seal the conduits at the BC Hydro vault, to prevent entry of moisture or gases and the spread of fire.

Note 30: The customer shall contact the local inspection authority and building department for compliance of the drainage connection of service ducts and cable pulling pits to the building drainage system.

8.3.3 Primary Service Ducts

The customer shall consult with BC Hydro to determine the number and size of the primary service entrance conduits and design details of the ducts to be installed. Proper drainage shall be provided for each duct run.

BC Hydro is particularly concerned with the installation of underground service ducts for primary service cables, to minimize the cable damage from pulling stress and abrasion caused by the duct walls. Therefore, BC Hydro may require the installation of pull boxes, if the length of service run is longer than 50 metres (150 ft.) or if the total number of duct bends exceeds 135° and/or cable pulling tension exceeds acceptable limits. For outdoor installation, BC Hydro may require a concrete pull box equivalent to the BC Hydro standard 832 Box. For indoor installation, subject to acceptance by the BC Hydro designer, a metal pull box may be used, 36" W × 72" H × 12" D in dimensions (or larger for back entry cables) and equipped with:

1) The BC Hydro acceptable cable bracing C-channel 1-⅝"×1-⅝" for BC Hydro supplied hardware;
2) A hinged cover door;
3) Shrouded penta bolts, and
4) A padlock hasp for the BC Hydro lock.

BC Hydro line crews use standard pulling harnesses and mandrels, which are best suited for the unrestricted diameter of the conduit. For this reason, conduits shall be installed using factory standard bends, with a 900 mm minimum radius, and sealed fittings to prevent ingress of sand and other sedimentary materials depositing inside the conduits.

Note 31: BC Hydro does not accept thin-wall EMT conduits for any type of installation inside a building or parkade. However, all primary metal-type conduits shall be bonded per BCEC rules. In addition, the ferromagnetic type conduit, if used, shall be de-rated for the capacity of single-core supply service cables.

All portions of the customer-installed service ducting shall be "proven" by having a suitable mandrel pulled through, in the presence of a BC Hydro representative, and all ducts shall be left with an acceptable #8 polypropylene pulling string in place.

In all cases, the service ducts shall be finished with an acceptable factory or machined bell end inside the pull boxes, pull pits and/or transformer pads.

8.3.3.1 Concrete Encasing

Where service ducts are specified to be encased in concrete, these ducts shall be CSA PVC type ducts or corrosion-resistant metal type (shall have concrete tight couplings and fittings) enveloped with a minimum concrete covering thickness of 75 mm and a minimum separation, both horizontally and

vertically, of 45 mm. The concrete shall be in accordance with the latest revision of CSA Specification A23, and have a minimum strength of 20 MPa at 28 days.

At locations where the service duct passes through, or enters into, a vertical concrete foundation wall, and where differential settlement may impose a shear force on the service duct, the customer shall ensure a smooth transition to avoid any damage to the ducts and conductors. The BC Hydro designer may request the customer to specify the estimated settlement of the building structure and required service cable slack, and the customer shall submit the engineered design of the concrete encased rebar reinforced wall entry for the service ducts to BC Hydro for acceptance — refer to the ES54 S3-03 standard.

8.3.3.2 Structural Supports

Extended runs of exposed rigid steel ducts inside the building shall be installed with support structures to hold the weight of the cables and steel ducts, and to withstand the required cable pulling forces during the installation and removal of service cables. Therefore, these exposed duct support structures shall be engineered.

8.3.4 Cable Pits

BC Hydro requires construction of cable pits for indoor vaults, and all service entrance conduits shall terminate in a cable pit under the primary service switchgear cubicle, unless otherwise advised by BC Hydro. The pit shall have sufficient dimensions to provide a minimum 900 mm radius bend to train the cable to the cable terminator and minimum 2100 mm length for cable pulling harness.

Cable pits shall extend outside the primary service switchgear to permit easy installation of service cables. For further design details, see the attached ES54 S3-03 standard showing typical installations.

Cable pits shall be covered by aluminium checker plates in areas not under the cubicle. In addition, where the cable pit extends underneath the cubicle, all cells (other than the cable entry compartments) shall have a metal base barrier installed to prevent possible worker exposure to live parts when working in a pit. This barrier may be an integral part of the switchgear. For further reference, see Section 8.2.1.

BC Hydro has specific weight requirements for cable pit covers, namely 25 kg maximum for a removable section and 40 kg maximum for a hinged section, pursuant to WorkSafeBC regulations and BC Hydro work methods, above energized cable pits. For this reason, a site meeting between the BC Hydro civil inspector and the electrical contractor shall be necessary to firm up the cable pit cover layout and details before manufacturing.

For service with future expansion requirements, the cable pit shall be sufficiently large with suitably placed pulling eyes and removable checker plate covers to enable the cables to be pulled and trained to enter existing or future switch locations without difficulty. It is the customer's responsibility to provide an adequate number of conduits to allow for future expansion, in consultation with BC Hydro.

Proper drainage shall be provided in each cable pit, as per Section 8.3.2.

8.4 Indoor Primary Service Vaults

Every electrical equipment vault, including the doors, ventilation and drainage, shall be constructed in accordance with the applicable requirements of the current BC Building Code Section 9.5.3 or applicable local legislation and the Authority Having Jurisdiction at the site.

All primary service vaults shall be built to accommodate 14.4/25 kV primary supply, even though the BC Hydro supply in the area may currently be 7.2/12 kV. This is required to minimize the impact of the future voltage conversion from 7.2/12 kV to 14.4/25 kV.

The vault shall provide a safe working space near the service entrance equipment including the metering provisions in accordance with the latest revision of the CEC, Part 1, Rule 2-308. In addition, BC Hydro requires a minimum of 1.5 metres clearance in front of the service cable compartment to apply safety grounds in accordance with BC Hydro Work Methods. Adequate illumination shall be provided to allow for proper operation and maintenance of electrical equipment, and the lighting shall be controlled by wall switches located at the entrance to these areas.

The primary service vault shall have an unobstructed means of egress in compliance with the National Building Code of Canada. Where compartment hinged doors or drawout components block the exit route, then a clear minimum space of 0.6 metres shall be maintained from the edge of the access door or components when in the fully open position.

> **Note 32:** BC Hydro shall not accept a customer primary service vault design utilizing a raised staircase from the vault floor as the only means of egress or emergency exit from the vault by BC Hydro personnel.

The passageways and working space around the electrical equipment shall not be used for storage, and they shall be kept clear of obstruction and arranged to give BC Hydro ready access to the service entrance and metering compartments.

8.4.1 Height

The vault height shall be of such dimensions as to accommodate the installed equipment with the minimum headroom of 2.2 metres. The vault size and all clearances shall meet the requirements of the TSBC (formerly BCSA), BC Electrical Code, BC Building Code and applicable local jurisdiction.

For slab-on-grade buildings, the primary service vault shall be located at the side of the building adjacent to the BC Hydro underground supply point with unrestricted access to the vault door directly from outside. For parkade type buildings, the primary service vault shall be in a location approved by the BC Hydro designer or Regional Distribution Engineer – not lower than P2 level. Access to the underground building parkade shall be suitable for the 2.1 metre maximum vehicle height of BC Hydro service vehicles.

The location shall also provide satisfactory access to allow unobstructed movement for replacement of equipment and access for personnel. All personnel access doorways shall be 900 mm (3ft) wide and equipment loading doors minimum 1200 mm (4ft) wide. Depending on equipment size, a larger doorway may be required. The vault door shall open outwards. The vault cable pull pit shall be drained to the building drain with the approval of the local building inspector.

Customers shall provide BC Hydro with the necessary access keys to the vault.

8.5 Outdoor Primary Service Kiosks

BC Hydro's preferred method for primary service kiosk connection is to eliminate the cable pull pit below the service kiosk, and replace it with a cable pull box located approximately 3.0 metres (10 ft.) from the kiosk concrete pad, as shown on the attached ES54 S3-01 and ES54 S3-02 standards in Appendix 2. This allows adequate sealing of the service conduits and prevents ingress of earth gases into the service

kiosk, which reduces deterioration of components and extends the life expectancy of the service kiosk. For further information, contact the BC Hydro designer.

BC Hydro will neither accept nor operate customer-owned loadbreak elbow cable terminators.

A specific type of primary service kiosk design, which has an integral oil-immersed loadbreak switch housed in a separate compartment attached to the transformer tank as a primary service switch, does not comply with BC Hydro Work Methods' requirements, or with this Primary Guide. BC Hydro line crews rely on a Class A electrician, who holds an annual permit for the customer-owned primary service, to operate customer-owned equipment for single radial supply. The location of the viewing window and the switch operating handle shall meet applicable CSA standards, and requirements of the local inspection and regulating authorities. For these types of installations, BC Hydro may accept a primary service cable pull box, equipped with loadbreak or deadbreak elbows. Loadbreak or deadbreak elbows will be supplied, installed and operated by BC Hydro.

> **Note 33:** A limited number of customer-owned primary service kiosks with loadbreak elbows and oil immersed service switches have been installed in the past, under special Local Operating Order provisions. However, these types of installations are no longer acceptable to BC Hydro.

BC Hydro now accepts a dead-front outdoor type primary service kiosk according to the ES54 S3-01 standard. For further information and BC Hydro requirements, refer to Section 5.6.

8.5.1 Sulphur Hexafluoride - SF_6 Filled Equipment

For improved safety, reliability and reduced cost of ownership, BC Hydro will accept SF_6 -insulated customer-owned primary service switches installed inside indoor type switchgear and in outdoor kiosks. However, the switch and the enclosure shall conform to the following BC Hydro requirements:

1) The customer shall provide a certified test report, which includes the initial volume of SF_6 gas, expected leakage rates and proof of load make-and-break capabilities at expected end-of-life gas volume;
2) Switches with an integral filling port shall be equipped with a pressure indicating device for low SF_6 gas pressure and a warning sign placed on the equipment;
3) The service switch shall be equipped with integral viewing ports for a clear view of the contacts in each pole in the open/closed/grounded positions, similar to BC Hydro's standard dead-front switchgear;
4) There shall be an integral grounding switch for each pole, mechanically interlocked to prevent direct switching from the grounded into a closed position;
5) Each switch enclosure shall contain screened and louvered ventilation ports on the front and back baseboards as means of egress for leaked-out SF_6 gas — minimum $1cm^2$ port per 1 litre volume of SF_6 gas contained inside the switch, and
6) The service kiosk shall be installed on a flat concrete pad with no cable pits below the switchgear. All cable conduits shall be sealed with an approved duct seal (see the ES54 S3-02 standard).

9 Primary Service Switchboard Construction

9.1 General

Construction of the entire primary service switchboard shall comply with the current edition of CSA C22.2 No. 31, current edition.

> **Note 34:** The incoming switchboard cell shall be designated as the customer service box and shall contain service fuses, a service switch or a breaker, and associated relaying and power monitoring devices. Customer branch feeders and apparatus not related to the primary service supply shall not be installed inside the incoming customer primary switch cell. BC Hydro relies on the customer's isolation switch for the point of isolation to work on the service cable.

Switchboard cells shall be constructed so that access to individual components can be readily obtained. Access to service cable terminations, loadbreak switches, disconnects (where required) and metering compartments shall be through single hinged panels, which are securely fastened by bolting and locking. For the outdoor-type primary services kiosk, BC Hydro requires "shoebox" type door panels with neoprene gasketing and three penta type bolts for full height 80" door panels. Hinges shall permit the full panel to swing open. For restricted access to the service cable compartment, the external cover door shall be equipped with a padlocking hasp and three penta bolts with welded pipe shrouds 34 mm I.D. (1-5/16") and 40 mm long (1-9/16").

Where heaters are required to maintain temperature and control moisture inside the switchboard cells, a separate heater power supply shall be provided from downstream of the metering supply point. The heaters shall be controlled by a humidistat and rated for 120 V minimum.

To minimize customer outage time caused by fuse operation, it is strongly recommended that spare fuses be supplied and stored in a separate wall mounted cabinet accessible to operating personnel. It is not acceptable to mount the spare fuses inside the switchgear fuse compartment if access to the spare fuses requires a power outage.

The service cable compartment shall be restricted for BC Hydro access only and reserved solely for mounting service cable terminations. Also, the service cable compartment shall remain free of junction boxes, terminal blocks, surge arresters or other ancillary devices.

The inside surfaces of compartments that have viewing windows shall be painted a light colour, to aid visual inspection of switch/breaker status.

For existing dual radial primary services, the service switchgear arrangement shall permit manual momentary paralleling of the two BC Hydro circuits during load transfer. Similarly, for existing double dual radial services, manual momentary paralleling of either of the two normal BC Hydro circuits and the standby circuit during load transfer is permissible. Such operations shall only be performed by BC Hydro personnel. There are exceptions for customers to operate these switches under a special agreement with BC Hydro. See Sections 9.3 and 9.4.

9.1.1 Additional Safety Requirements for Service Cable Compartments

As required by WorkSafeBC and BC Hydro Work Methods for installation of personnel safety grounds, a ball-stud (acceptable to BC Hydro per the ES54 S3-01, S3-02 and S3-03 standards) shall be permanently

mounted on each of the phase bus bars, as well as the equipment ground bus in the service entrance compartment. Ball-studs shall be positioned such that they will accept universal grounding ball clamps operated from hot sticks. This safety grounding provision will enable BC Hydro line crews to install safety grounds on each of the main bus bars.

With primary revenue metering, BC Hydro requires the extension of a ground bus and additional seven grounding ball studs in the revenue metering cubicle — one grounding ball stud on either side of three CTs and one grounding ball stud bolted to the ground bus. BC Hydro requirements are available from the BC Hydro web site at: http://www.bchydro.com/distributionstandards

BC Hydro personnel require safe access into the customer-owned primary service cable compartment and instrument transformer compartment. For this purpose, BC Hydro personnel shall be able to complete a visual inspection of the primary service visible disconnection point, i.e. the isolation switch open and switch blades pulled down from the line contacts above. For customer-owned primary services with oil-filled or vacuum type circuit breakers or switches as the customer primary service disconnecting device, BC Hydro accepts draw-out-type switchgear. Alternatively, these disconnecting devices shall be preceded with an air-insulated disconnect switch as an acceptable safety barrier and visible disconnection point.

> **Note 35:** Open contacts inside an oil-filled or vacuum bottle (as a primary service disconnecting device) are not an acceptable safety barrier for safe access into a primary service cable compartment or instrument transformer compartment.

To comply with the regulations governing the limits of approach, WorkSafe BC and BC Hydro Work Methods, all exposed cable connections and buswork inside the primary service cable compartment shall be covered with removable insulation barriers, to prevent accidental contact with energized live parts. In particular, the buswork may be covered with rated polymer-based material, whereas cable connections and grounding balls may be covered with adequately rated, removable insulation boots. For design and installation details, please refer to the ES54 S3-02 standard in Appendix 2 and Photograph 1 in Appendix 3.

For further information, see BC Hydro Safety Practice Regulations, Rule 401.

9.1.2 Viewing Window

Viewing windows are required to enable BC Hydro personnel, for safety reasons, to ascertain the status of all switches and circuit breakers — refer to “Visible Disconnection Point” in the Definitions section of this guide. The windows shall be of wired glass or heat-tempered plate glass, and shall be sized and positioned such that a viewer can conveniently observe the switch blade status with the access door closed. If one window is supplied for an indoor type air-rated switch, it shall have minimum dimensions of 250 x 380 mm.

SF_6 insulated primary service switches shall incorporate integrated viewing ports to allow for visual inspection of the switch contacts, with moving and stationary contacts clearly visible, similar to BC Hydro standard dead-front switchgear. The viewing ports shall meet the requirements of applicable CSA, CEC and TSBC (formerly BCSA) regulations and carry the certification mark of approval. In addition, viewing ports shall be accessible from the ground level without the use of a ladder and shall be acceptable to BC Hydro.

> **Note 36:** Dead-front primary service equipment shall be equipped with viewing ports for a clear view of the contacts in each pole in the open/closed/grounded positions. The use of cameras is not acceptable.

9.1.3 Operating Handle

The height of the operating handle pivot point for loadbreak switches operated by BC Hydro line crew shall not be more than 1.5 metres above the vault floor.

Where a chain is used between an operating handle and a loadbreak **or** disconnect switch, a guard shall be provided such that, if the chain breaks, it will not come into contact with any live parts.

9.1.4 Interlocks

Interlocks shall be provided between the service loadbreak switches, disconnect switches and primary metering compartments or cells (padlocks not acceptable) in accordance with CSA C22.2 No. 31, latest edition.

See attached drawing PG A2-02 for typical interlocking details for dual supply.

9.1.5 Bolted Bus Bar Sections

To minimize customer outage time, it is recommended that, for existing dual radial configurations where sections of bus are required to be bolted and removable for equipment maintenance purposes, a sheet metal barrier shall be provided for insertion in the gap when bus sections are removed. The metal barrier shall be of a slide-type and suitably fastened in storage in the loadbreak switch compartment when not in use.

CSA-standard phase-to-ground clearance shall be observed between the bus or component ends and the inserted metal barrier.

9.2 Service Entrance Cell — Single Radial Supply

For single radial supply service, separate compartments in the service entrance cell are required for the service cable terminations and customer's loadbreak switch. Also:

1) Loadbreak switches and fuses shall be installed in separate compartments connected by bus bar sections;
2) Proper termination space and cable supports shall be provided, as detailed on the attached standards ES54 S3-01, S3-02 and S3-03. Base spacers separated to match each enclosure can be used to increase the cable termination height to meet BC Hydro height requirements, and
3) Key interlocks shall be provided between the loadbreak switches and fuses so that the fuse compartment cannot be opened unless the loadbreak switches are locked open.

See attached drawing PG A1-01 for a one-line diagram.

Note 37: BC Hydro line crews will rely on a Class A electrician holding an annual permit for the customer-owned primary service installation, to operate customer-owned equipment for single radial supply. Location of the viewing window and the switch operating handle shall meet applicable CSA standards and requirements of the local inspection and regulating authorities.

9.3 Service Entrance Cell — Dual Radial Supply (Legacy Reference)

The existing dual radial service entrance equipment shall have an arrangement and layout such that it shall be possible to safely service or replace the following components of the service entrance switchgear with minimum interruption of service:

1) service cable termination;
2) service disconnect switch, and
3) service loadbreak switch or a breaker.

This shall be made possible by the operation of switches and mechanical removal of bolted bus bar sections. A brief outage will be required to allow safe isolation of the components for servicing.

The following should be noted for the existing dual radial supply switchboards:

1) Cable terminations, disconnect switches, loadbreak switches and the fuse/circuit breaker shall be installed in separate compartments connected by bus bar sections (removable bus links as required);
2) Viewing windows shall be provided (see Section 9.1.2.);
3) Provision shall be made for padlocking the loadbreak and disconnect switches with BC Hydro standard padlocks when the switches are in the open position, and
4) Dual supply switches, forming a part of the customer-owned switchgear, shall be equipped with acceptable locking provisions for restricted access and operation by BC Hydro personnel only.

9.4 Service Entrance Cell - Dual Supply

The dual supply service entrance equipment shall meet all requirements in Section 9.3. Refer to the attached drawing PG A2-02 in Appendix 1 and ES54 E6-02 in Appendix 2, which show a typical layout and configuration of the primary service connections and BC Hydro requirements.

1) Provision shall be made for padlocking the loadbreak and disconnect switches, and tie switch with BC Hydro standard padlocks when the switches are in the open position.

   Note 38: All dual radial supply customer-owned switches and associated equipment shall be maintained by the customer, in accordance with regular Maintenance Notices issued by BC Hydro to the customer. For further information, refer to Appendix 2, Maintenance Standards ES64-C-03.06.

10 Primary Service Protection Requirements

10.1 Equipment Rating

10.1.1 Current

The equipment shall be rated in accordance with the applicable CSA Standards.

10.1.2 Voltage

The equipment shall be rated to BC Hydro's system voltage.

Note 39: Where the service entrance equipment is installed in an area scheduled for future voltage conversion to 25 kV, provisions shall be made to the equipment, such as fuse holders, insulation level etc., so that it could operate at 25 kV, with minimal modifications. Equipment for 25 kV conversion, not in use at 12 kV, is to be stored in a clearly labelled and accessible compartment.

10.1.3 BIL

The minimum BC Hydro requirement for BIL rating of customer-owned equipment is:

a) 60kV BIL on the 4.16 kV system;

b) 95kV BIL on the 12.5 kV system;

c) 125kV BIL on the 25 kV system, and

d) 150kV BIL on the 34.5 kV system.

10.1.4 Interrupting Rating and Minimum Time Margins

The customer's service main shall have the following minimum fault interrupting rating, fault closing and withstand and short circuit bracing as shown in Table 1 below:

	Interrupting Rating		
	Circuit Breakers/Reclosers	**Fuses**	
Type of Service	Symmetrical MVA	Asymmetrical rms Amperes	Symmetric rms Amperes
4.16 kV, 3Ø 4-Wire	50	12,000	7,500
12.5 kV, 3Ø 4-Wire	250	20,000	11,500
25 kV, 3Ø 4-Wire	500	20,000	11,500
34.5 kV, 3Ø 4-Wire	300	9,000	5,000

Table 1 — Interrupting Rating and Fault Withstand

The customer primary service overcurrent protection should coordinate with BC Hydro's upstream protection devices. BC Hydro will be responsible for identifying the upstream protection device and communicating the protection and fault levels at that location to the customer.

The minimum separation between the customer's service main protection total clearing time and the BC Hydro protection device shall not be lower than the minimum value defined in Table 2 below. The total clearing time of the customer service main protection includes: relay response time, breaker interrupting time, and all other propagation and power-up delays that are required to clear the fault afterwards.

BC Hydro Protection	Customer Entrance Protection Minimum Time Margins		
	Fuse	**Electromechanical Relay**	**Digital Relay**
Fuse	12 cycles (0.2 s)	18 cycles (0.3 s)	12 cycles (0.2 s)
Electromechanical Relay	18 cycles (0.3 s)	24 cycles (0.4 s)	18 cycles (0.3 s)
Digital Relay	12 cycles (0.2 s)	18 cycles (0.3 s)	12 cycles (0.2 s)
Recloser	12 cycles (0.2 s)	24 cycles (0.4 s)	18 cycles (0.3 s)

Table 2 — Minimum Separation of Protective Devices

10.2 Protection with Relays and Circuit Breakers

10.2.1 Current Transformers

Current transformers for protection and relaying shall have mechanical and thermal ratings adequate for the expected fault duty.

BC Hydro requires that the current transformers be located at the source side of its associated circuit breaker, but at the load side of the disconnect switch—see attached drawing PG A1-01. The requirement for the current transformer to be on the source side is to avoid the dead zone in the customer primary service switchgear protection.

If a customer installs CTs on the load side of a circuit breaker, such as a draw-out breaker or interlocked switch and interrupter assembly, the customer shall provide verification that this configuration dead zone shall be less than one quarter of a cycle.

If the same CT/relay set on the source side of the breaker is compared to the load side, the additional reaction and propagation delay of the CT/relay set on the load side shall not exceed one quarter of a cycle.

10.2.2 Relays

BC Hydro does not require that the customer's service entrance protective relays be tested and approved by BC Hydro, provided that the relays meet with the minimum requirements specified in ANSI/IEEE C37.90, latest edition. However, BC Hydro will require that the customer performs a commissioning test to

verify the customer's relays perform as specified, including a primary or secondary injection test (pick-up, reset and timing) and tripping test. A copy of the relay commissioning report, signed by a Professional Engineer, shall be submitted to BC Hydro prior to energization, as stated in Section 5.4.

> **Note 40:** For special applications, or a particular service failure, BC Hydro reserves the right to request the customer to have the protective relay tests performed by an independent test facility, such as Powertech, for acceptance by a BC Hydro accredited representative.

The overcurrent relays may be arranged as three-phase relays, or as two-phase relays and one ground relay. The latter arrangement will be required for larger installations for coordination with BC Hydro ground relays and is generally preferable. The ground relay can be as sensitive as unbalanced loading and inrush will permit.

The minimum separation between the characteristics of the customer's relay and BC Hydro's feeder relay at maximum fault current at the customer's installation shall be maintained as described in Table 2 above. Differential relay protection alone on the customer's main breakers is not acceptable—it shall be accompanied by overload protection.

Phase and ground instantaneous trip: customer protection should be capable of instantaneous tripping. Protection operation will be accepted as instantaneous if protection operation below three cycles can be guaranteed above an adjustable threshold. The instantaneous element threshold should be set at:

1) Not higher than 80 percent of the BC Hydro instantaneous element (if existing), and
2) Lower than the fault current where the coordination margin described in the previous table cannot be guaranteed.

It is recommended for customers to use separate phase and ground relay curves when upstream BC Hydro protection device is a relay, dead-front switch gear, or a recloser.

10.2.3 Circuit Breakers

Circuit breakers shall have a maximum interrupting time of no more than five cycles. Circuit breakers may be equipped with either an AC trip coil or DC voltage shunt trip coil. If the latter is applicable, the customer shall be responsible for adequate maintenance of its battery supply. If a stored energy voltage trip scheme is applied, such as a capacitor trip, the voltage supply for charging the capacitors shall come from the source side of its associated circuit breaker.

A fixed-type circuit breaker (as a service main) shall be equipped and interlocked with a service disconnect switch - as shown on PG A1-01.

A draw-out type circuit breaker (as a service main) equipped with lockout and grounding provisions in a draw-out position is acceptable.

A utility type recloser programmed for single shot operation, approved by the electrical inspection Authority Having Jurisdiction, is acceptable to BC Hydro as a service main circuit interrupter.

10.3 Protection with Fuse and Loadbreak Switch

10.3.1 Fuse Size

Fuses shall have time-current characteristics that will coordinate with the upstream BC Hydro protective device.

At the time of submission (see paragraph 5.2.2), the customer must consult the BC Hydro designer for the BC Hydro upstream protective device details for a particular primary service connection.

It is not feasible to prepare a table of fuse sizes for each transformer connection; hence the following general design criteria should assist as a guide:

1) The fuse shall be sized as small as possible and shall conform with the latest Canadian Electric Code and the BC Amendments;
2) The fuse shall withstand magnetizing inrush current, which varies from eight to 12 times the rated current of oil filled transformers for 0.1 to 0.2 seconds. The transformer design greatly affects the magnitude of the inrush current;
3) Short circuit withstand and overload ratings shall exceed the fault currents listed in Table 1, and
4) The fuse shall coordinate with the BC Hydro upstream protective device. .

See attached drawing PG D2-01 for BC Hydro “preferred” type T fuse curves. T type fuse curves have a built-in de-rating factor of approximately 75 percent, such that the maximum clearing time of the customer’s fuses will be no greater than 75 percent of the minimum melting times of BC Hydro’s fuses. Corresponding type E fuses do not require de-rating. The purpose of the de-rating is to compensate for ambient temperature variance, pre-loading and pre-damage effects. For type E fuse curves, see attached drawings PG D3-01 to PG D3-03.

10.3.2 Loadbreak Switch

The use of loadbreak switches as a primary circuit opening device for secondary ground fault protection application is **not** acceptable for any type of customer-owned primary service applications.

Appendix 1 List of Distribution Standards

Disclaimer: The person using this manual is responsible for ensuring that the reference documents attached herein are the up-to-date latest revisions.

A Electrical Schematics

PG A1-01 One Line Diagram Single Radial Supply Typical for U/G Supply Service

PG A1-02 One Line Diagram Single Radial Supply Typical for O/H Supply Service

PG A2-01 One Line Diagram Dual Supply

PG A2-02 Dual Supply Service – Four Key Interlock

B Civil Plan

PG B1-01 Simplified Site Plan and Primary Vault Layout (Deleted)

C Service Cables

PG C1-01 through PG C2-03 (deleted). All information and design details are shown on ES54 S3-01, S3-02 and S3-03 standards attached in Appendix 2.

D Protection Coordination

PG D1-01 Sample Protection Curves Customer Services and BC Hydro (2 sheets)

PG D2-01 Type T Fuse Time-Current Curves

PG D3-01 Type E Fuse Minimum Melting Time-Current Curves All Voltage Ratings

PG D3-02 Type E Fuse Total Clearing Time-Current Curves 4.6 kV and 14.4 kV Ratings

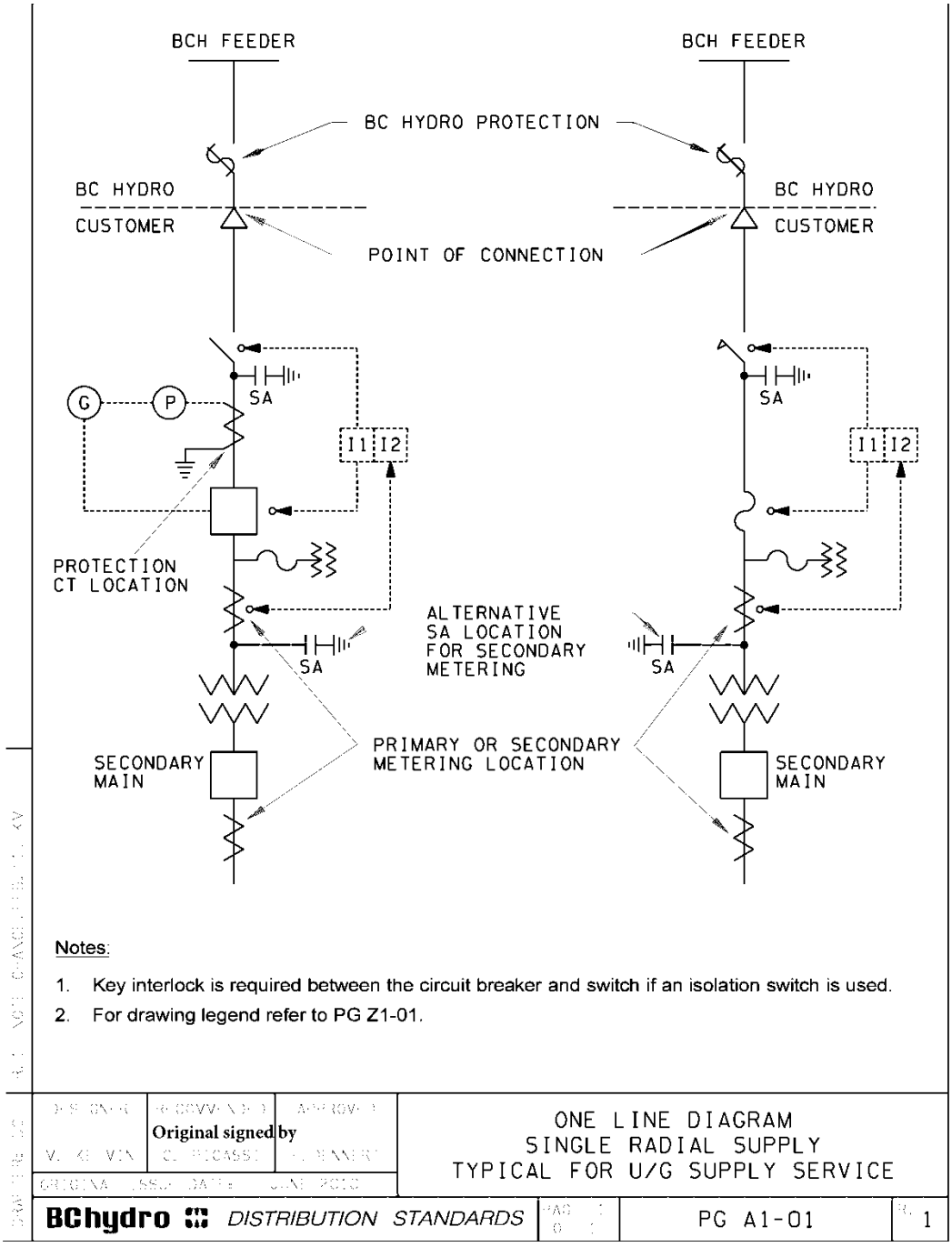
PG D3-03 Type E Fuse Total Clearing Time-Current Curves 25 kV and 34.5 kV Ratings

Z Engineering Data

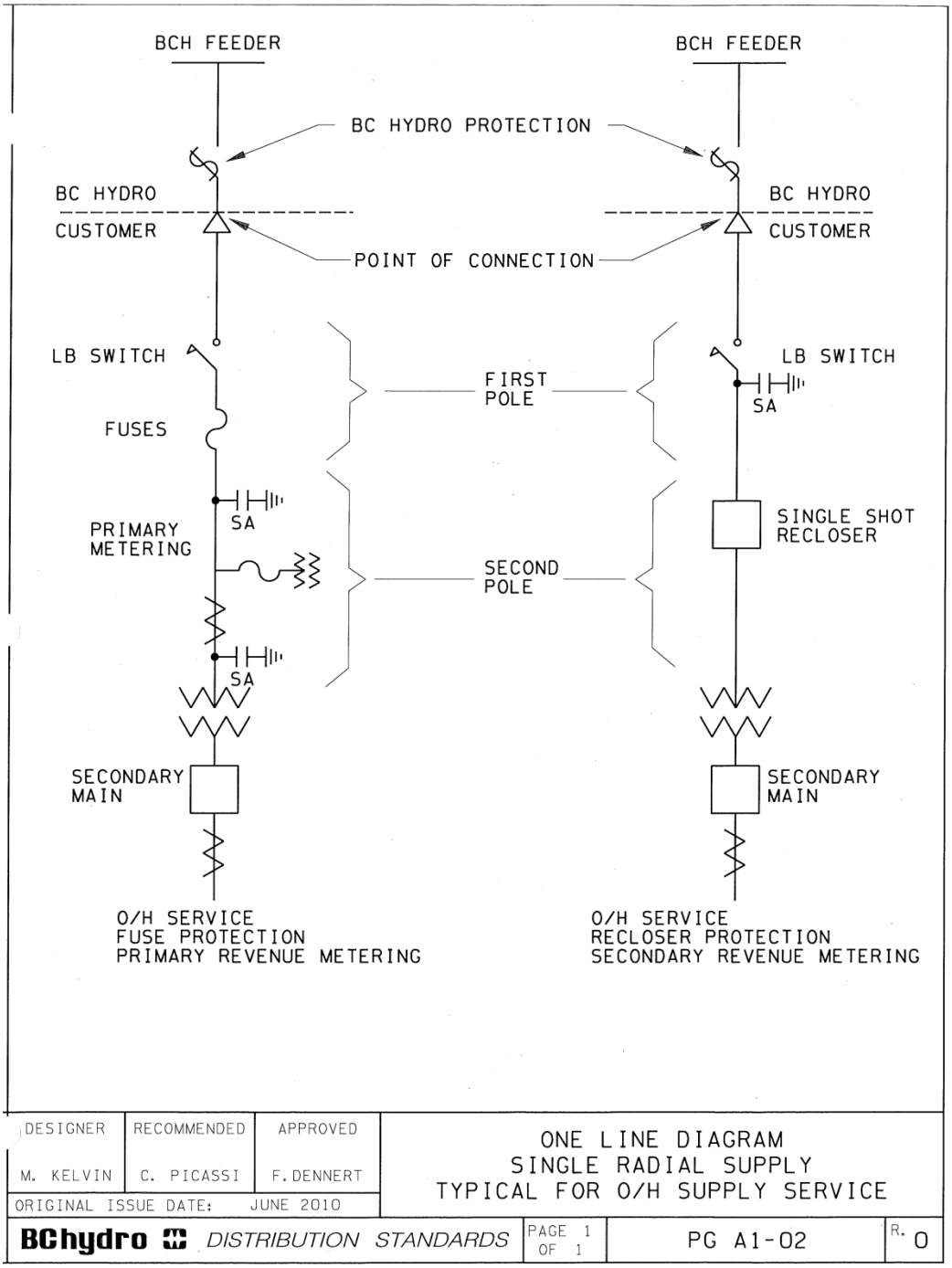
PG Z1-01 Primary Voltage Services Drafting Legend

A Electrical Schematics

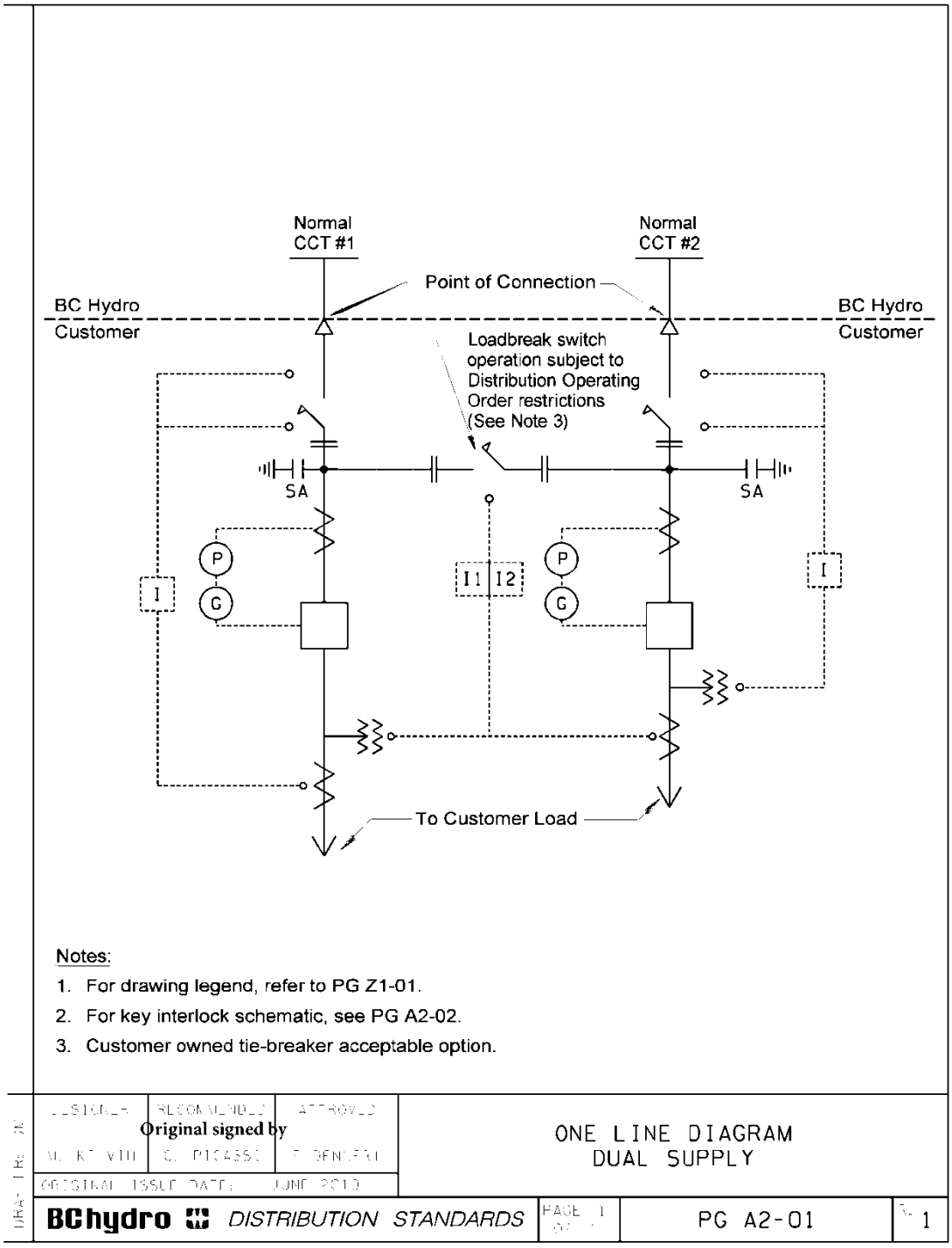
PG A1-01 One Line Diagram Single Radial Supply Typical for U/G Supply Service



PG A1-02 One Line Diagram Single Radial Supply Typical for O/H Supply Service



PG A2-01 One Line Diagram Dual Supply



Notes:

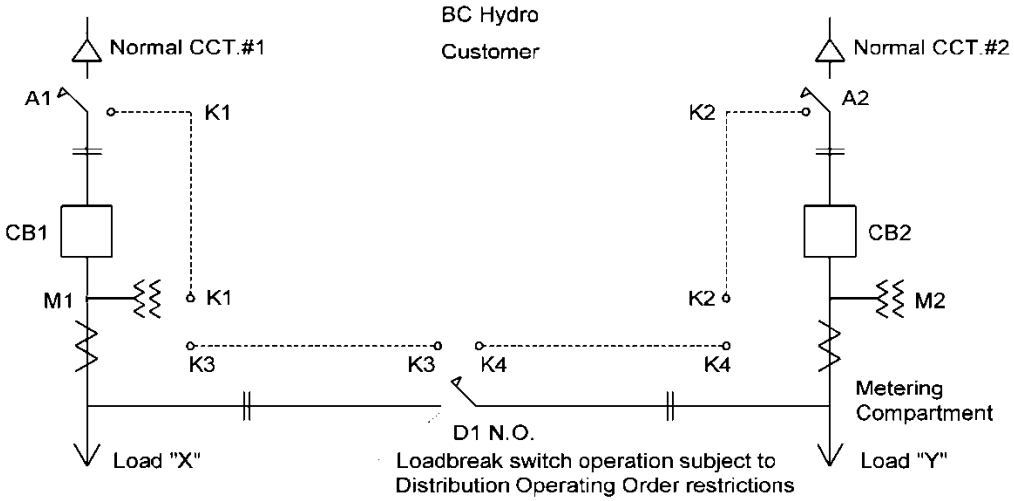
1. For drawing legend, refer to PG Z1-01.
2. For key interlock schematic, see PG A2-02.
3. Customer owned tie-breaker acceptable option.

DESIGNED	RECOMMENDED	APPROVED	ONE LINE DIAGRAM DUAL SUPPLY
M. KETVITI	C. PICASSO	P. GENEREUX	
ORIGINAL ISSUE DATE: JUNE 2010			
BC hydro DISTRIBUTION STANDARDS	PAGE 1 OF 1	PG A2-01	1

Original signed by

DRA-TRS-JE

PG A2-02 Dual Supply Service – Four Key Interlock



Purpose of Key Interlock System

1. Allows momentary paralleling of either of the circuits during load transfer.
2. Prevents unsafe operation of disconnect switches and unsafe access to circuit breaker or metering compartment.

Key Interlock Sequence:

I. Access to BC Hydro metering compartment M1:
Open load-break switch A1 and release key K1. Retrieve K3 from D1 which is locked open. Insert K1 and K3 into M1 and open BC Hydro metering compartment M1. Follow the same procedure to access metering compartment M2.

II. To feed load "X" by normal circuit #1:
Open D1. Remove K1 from metering compartment M1. Insert K1 into A1 and close loadbreak switch A1 to feed load "X". Close circuit breaker CB1. Energizing the circuit follow the same procedure when feeding load "Y" by normal circuit #2.

III. To transfer load "X" from normal circuit #1 to circuit #2:
Close load-break D1 (K3 held captive). Momentarily parallel normal circuit #1 with circuit #2. Open load-break A1 and release key K1. Load "X" is now transferred to CCT #2. Similar procedure applies when transferring load "Y" from normal circuit #2 to circuit #1.

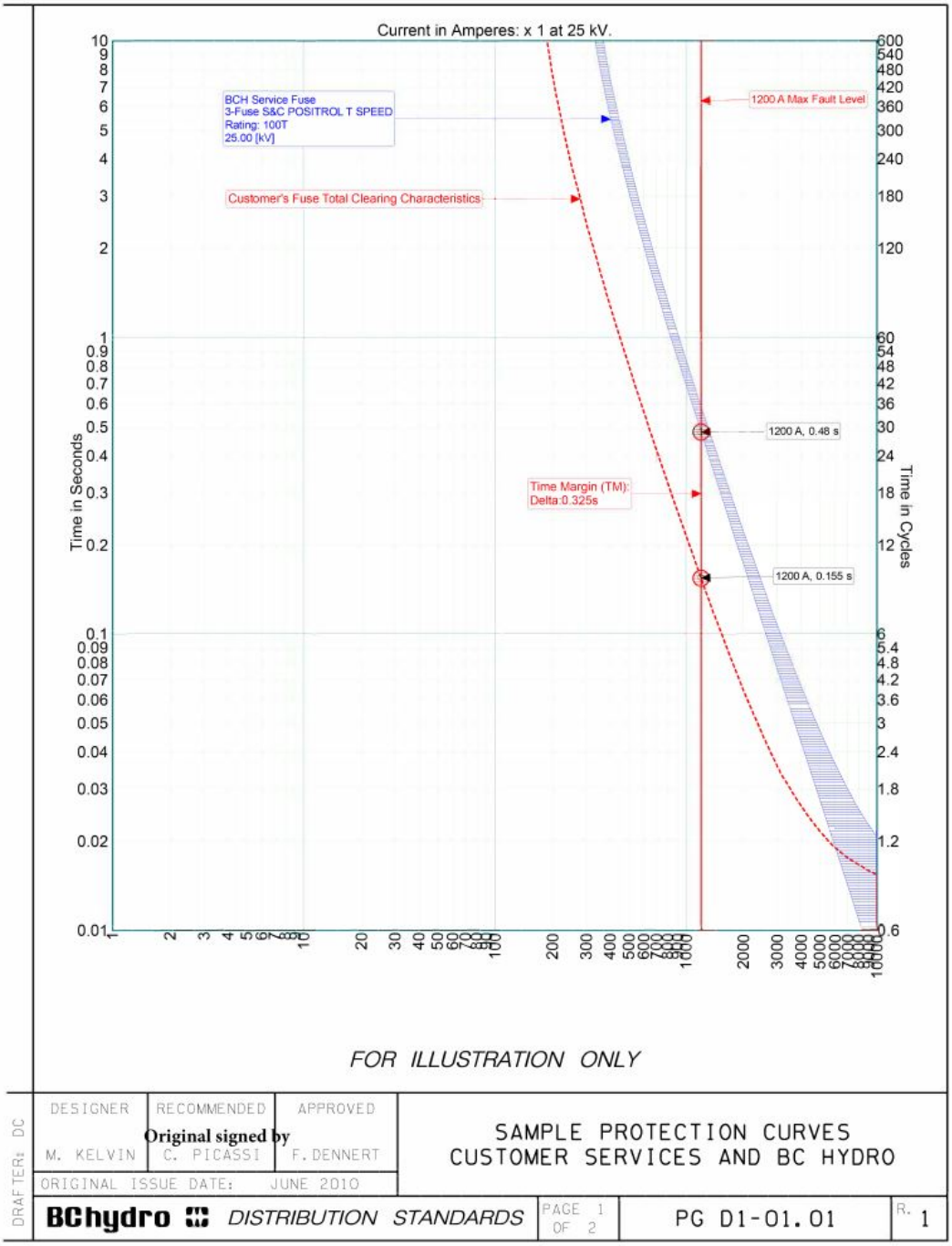
Note:

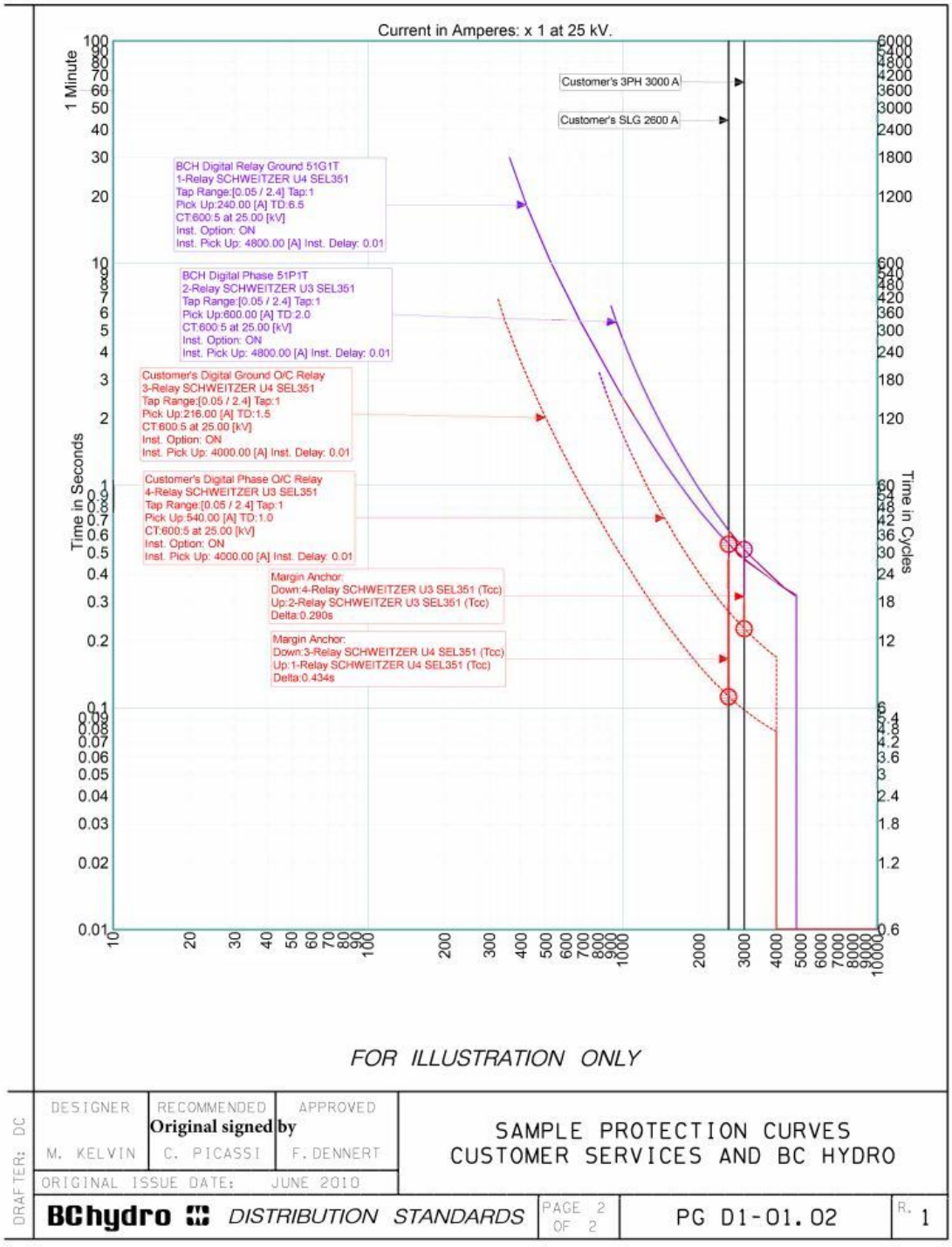
1. Key interlock is required between the circuit breaker and switch.
2. Distribution Operating Order (DOO) is required for Dual Supply installations.
3. For drawing legend refer to PG Z1-01.

Original signed by		DUAL SUPPLY SERVICE FOUR KEY INTERLOCK	
BC hydro DISTRIBUTION STANDARDS		PG A2-02	1

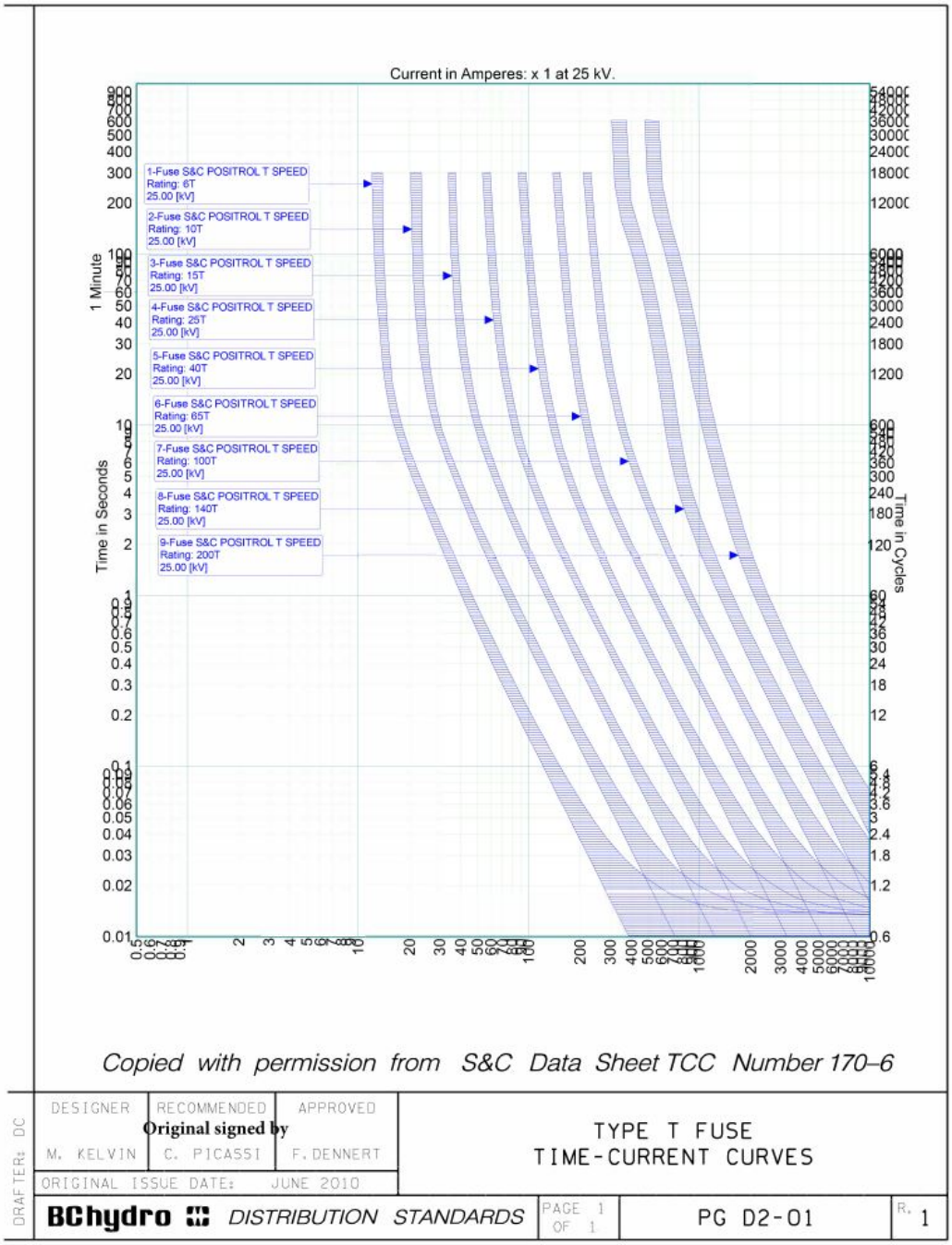
D Protection Coordination

PG D1-01 Sample Protection Curves Customer Services and BC Hydro (2 sheets)





PG D2-01 Type T Fuse Time-Current Curves

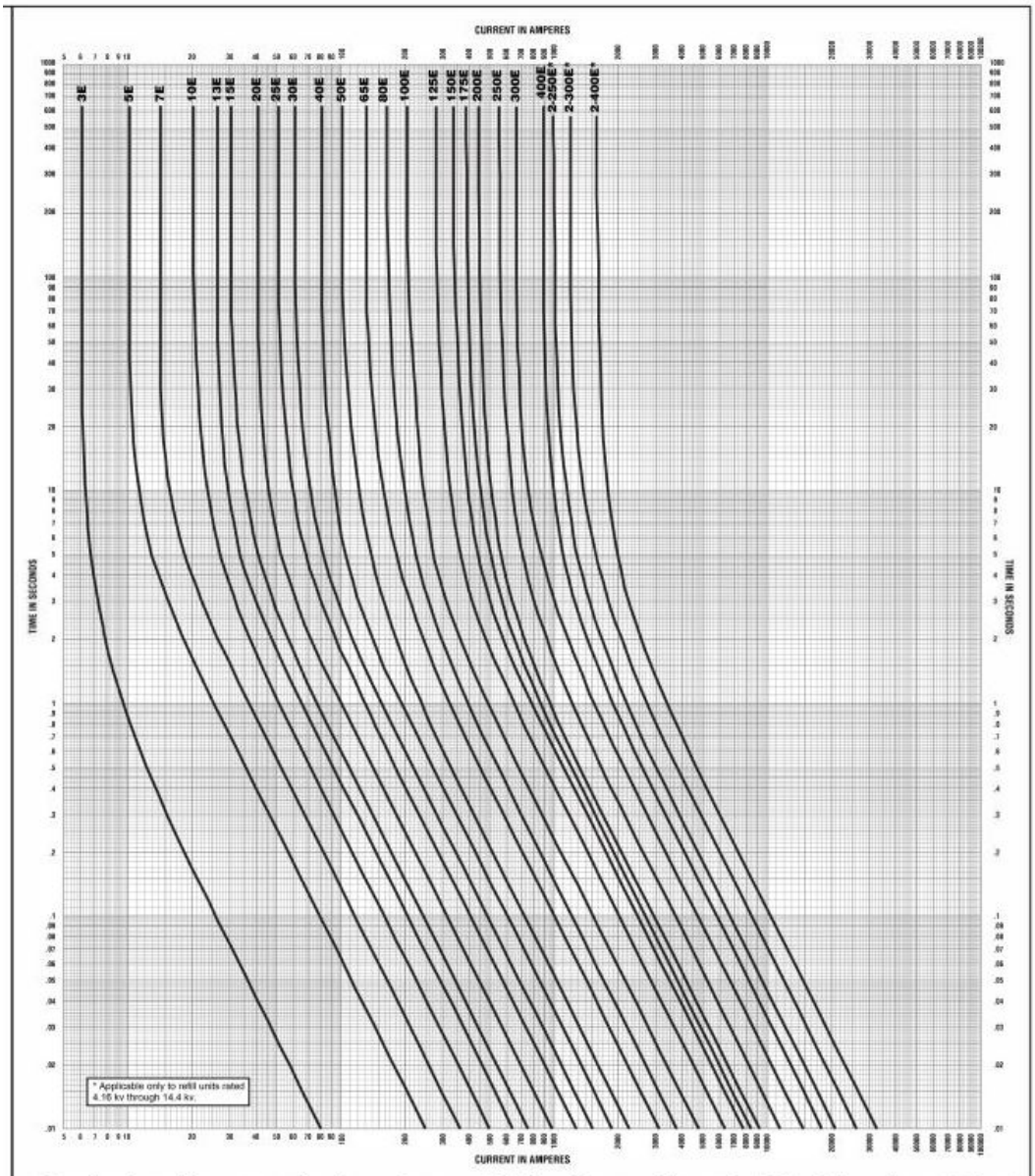


Copied with permission from S&C Data Sheet TCC Number 170–6

DESIGNER	RECOMMENDED	APPROVED	TYPE T FUSE TIME-CURRENT CURVES
M. KELVIN	Original signed by C. PICASSI	F. DENNERT	
ORIGINAL ISSUE DATE: JUNE 2010			
BC Hydro DISTRIBUTION STANDARDS	PAGE 1 OF 1	PG D2-01	R. 1

DRAFTER: DC

PG D3-01 Type E Fuse Minimum Melting Time-Current Curves All Voltage Ratings



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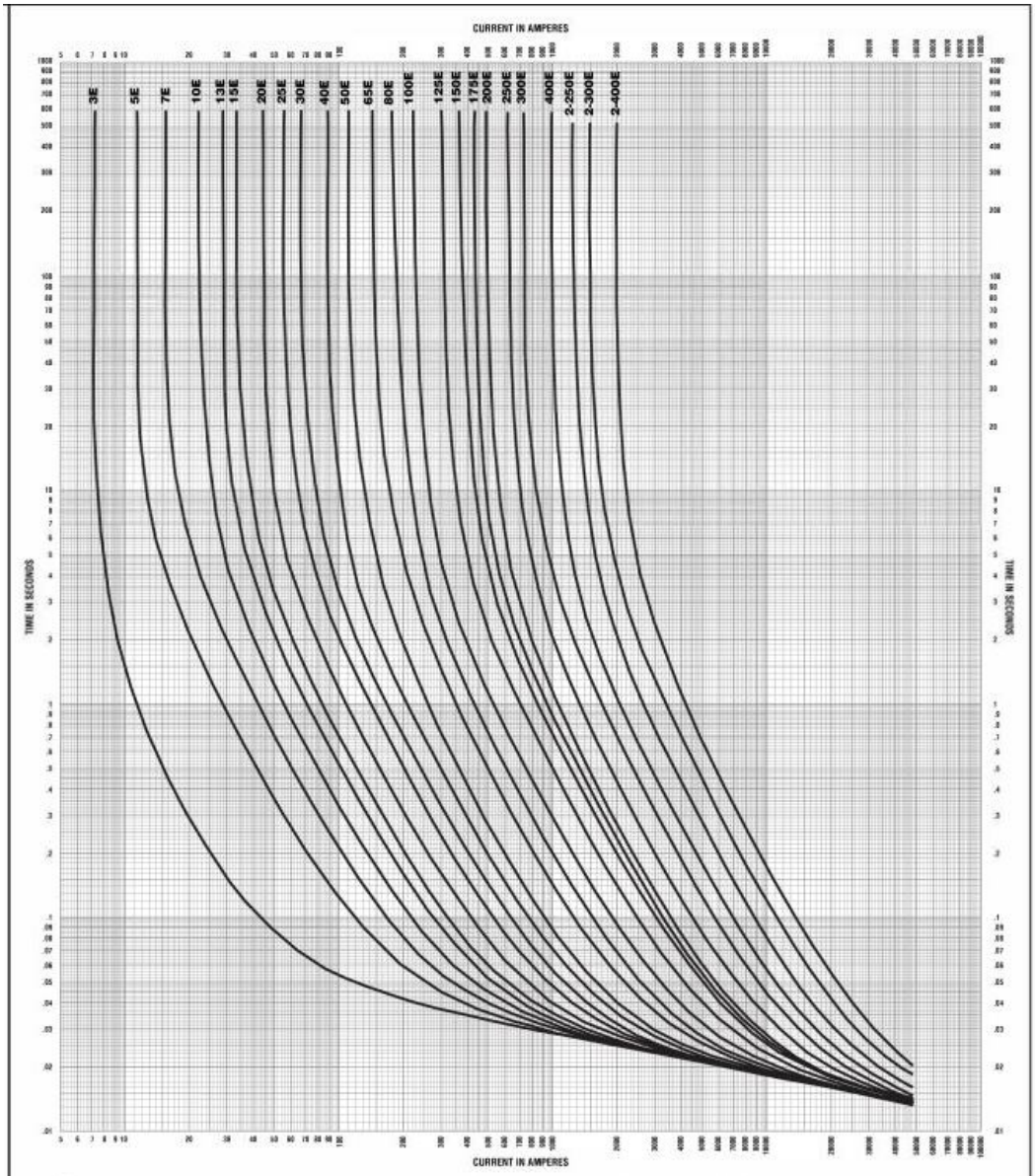
DESIGNER	RECOMMENDED	APPROVED	TYPE E FUSE MINIMUM MELTING TIME-CURRENT CURVES ALL VOLTAGE RATINGS
M. KELVIN	Original signed by C. PICASSI	F. DENNERT	
ORIGINAL ISSUE DATE: JUNE 2010			
BC hydro DISTRIBUTION STANDARDS	PAGE 1 OF 1	PG D3-01	R. 0

PG D3-02 Type E Fuse Total Clearing Time-Current Curves 4.6 kV and 14.4 kV Ratings



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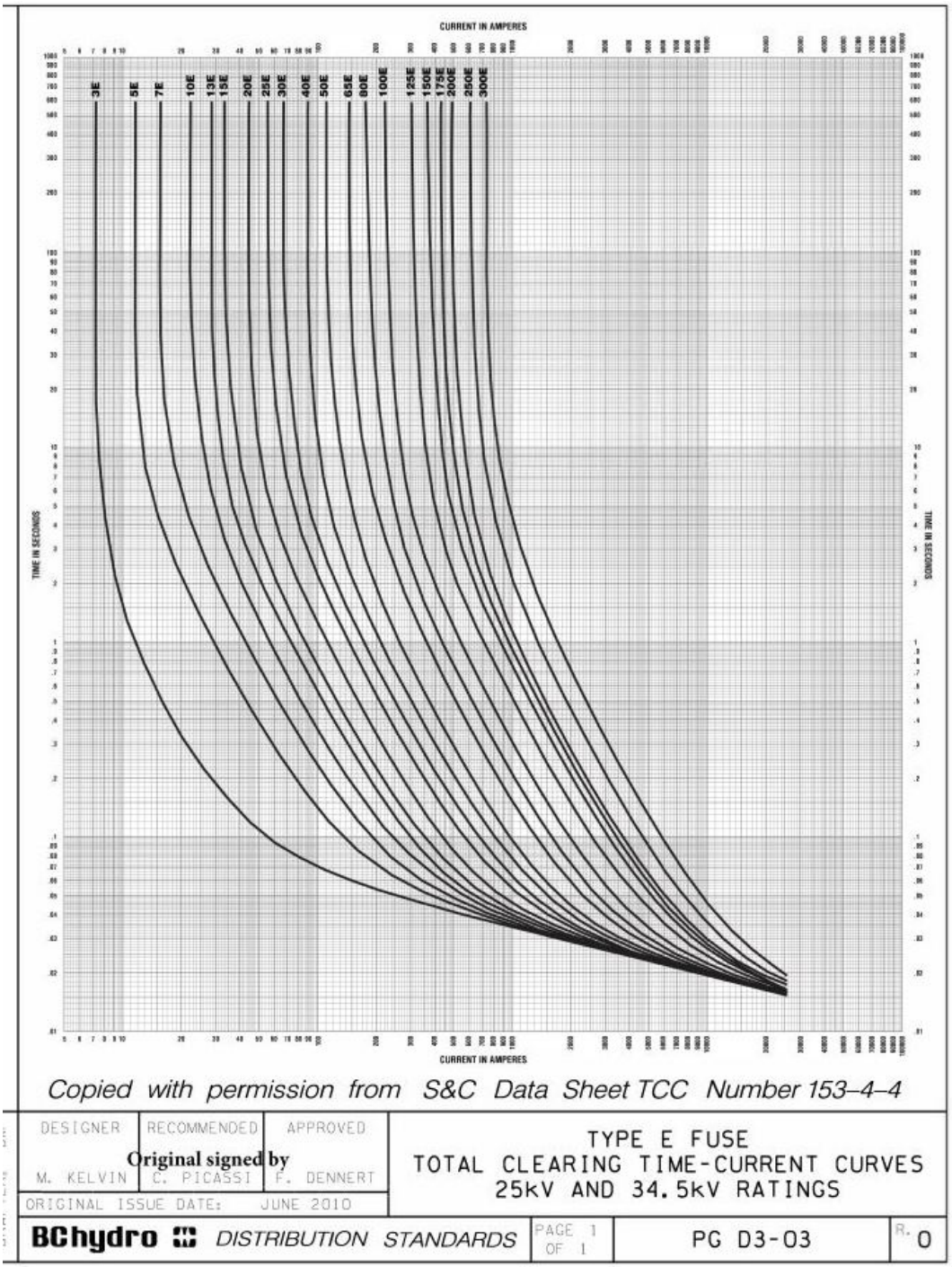
DESIGNER	RECOMMENDED	APPROVED	TYPE E FUSE TOTAL CLEARING TIME-CURRENT CURVES 4.6kV THROUGH 14.4kV RATINGS
M. KELVIN	Original signed by C. PICASSI	F. DENNERT	
ORIGINAL ISSUE DATE: JUNE 2010			

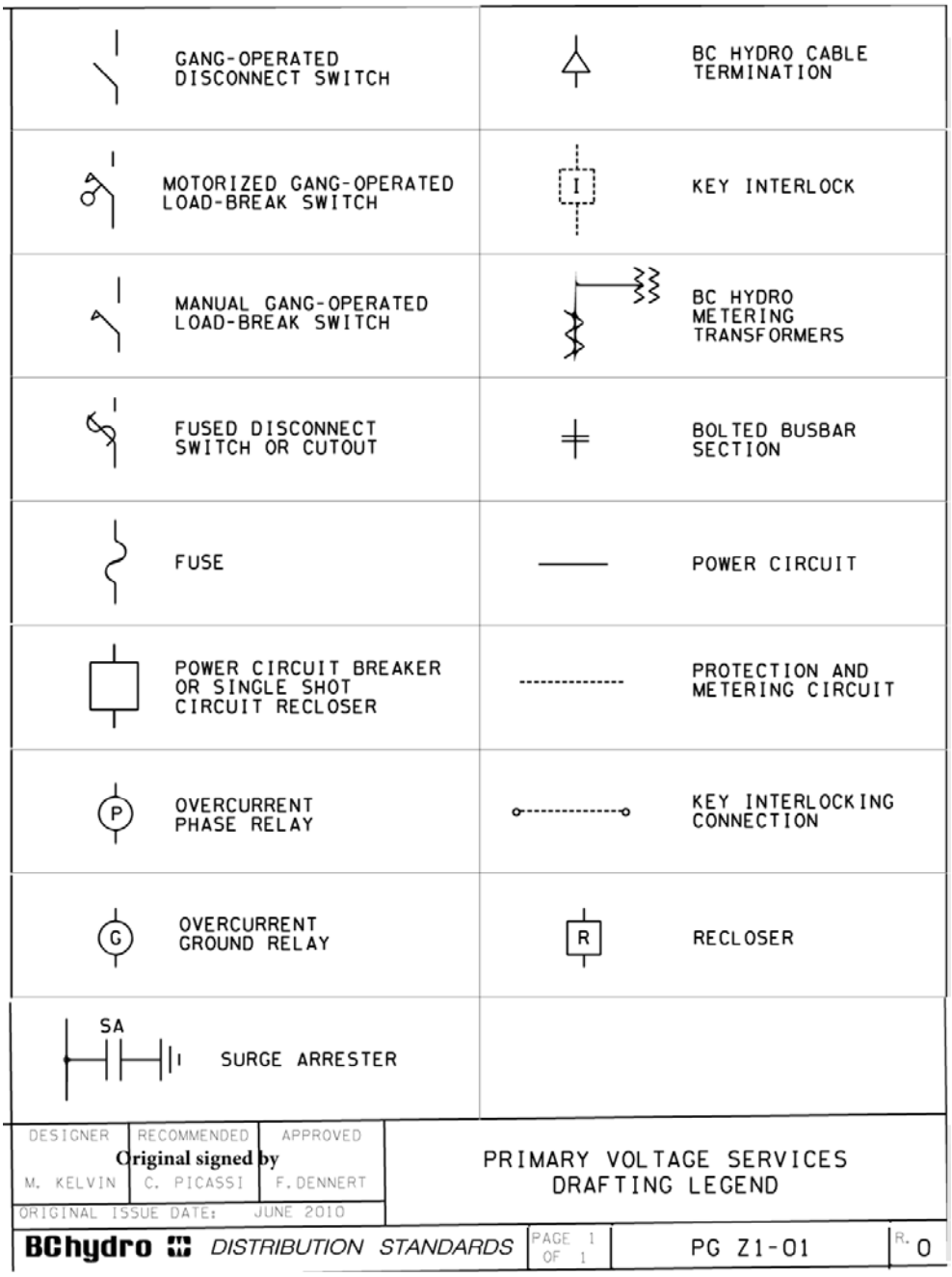
BC hydro DISTRIBUTION STANDARDS | PAGE 1 OF 1 | PG D3-02 | R. 0

PG D3-03 Type E Fuse Total Clearing Time-Current Curves 25 kV and 34.5 kV Ratings



Z Engineering Data

PG Z1-01 Primary Voltage Services Drafting Legend

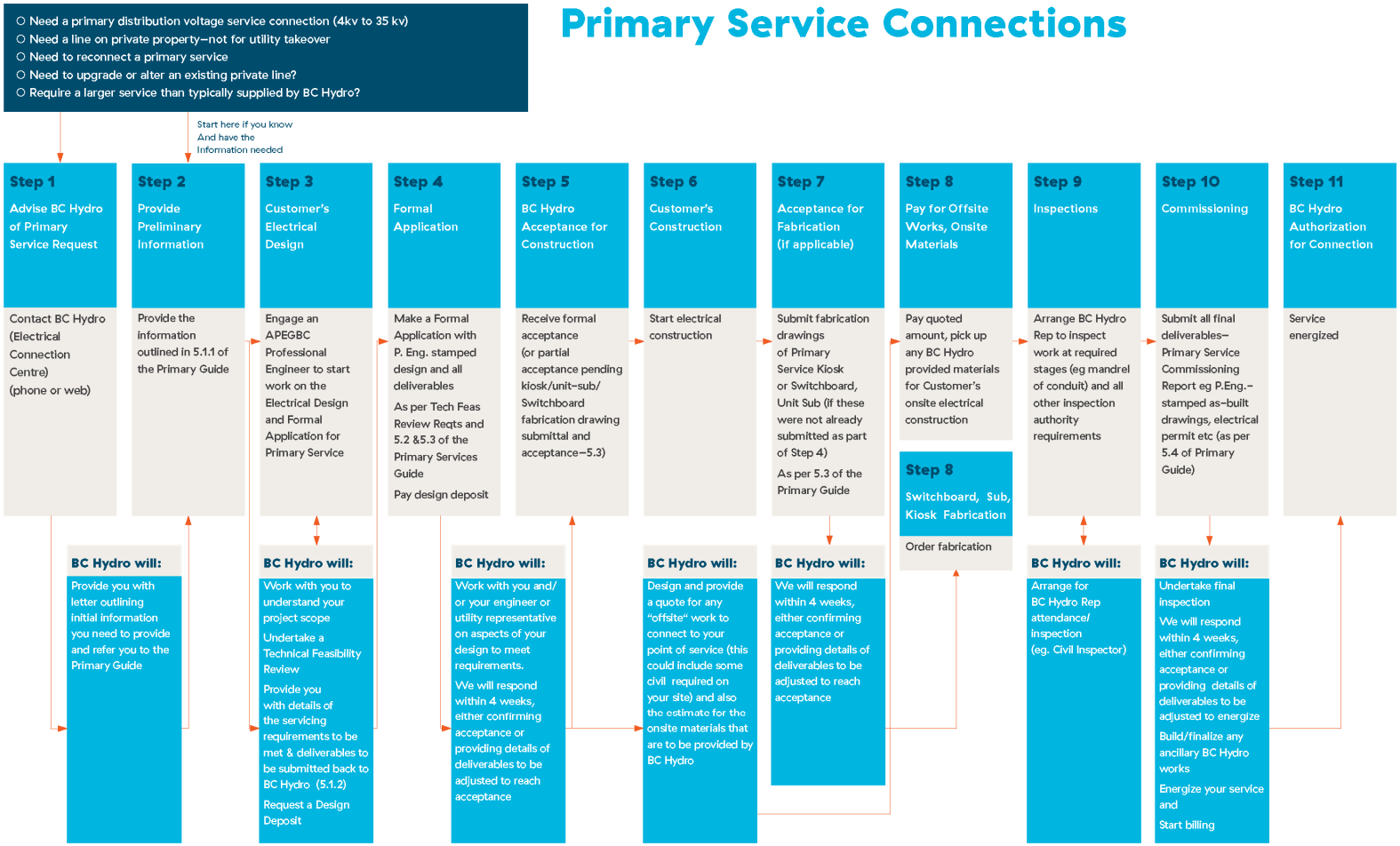


Appendix 2 Reference Documents and Standards

Disclaimer: The person using this manual is responsible for ensuring that the reference documents attached herein are the up-to-date latest revisions. All documents identified as BC Safety Authority shall be read as Technical Safety BC.

FLOWCHART	Primary Service Connections from the Customer's Perspective
TSBC (BCSA) DIRECTIVE D-E3 090313 1	High Voltage Installations
TSBC (BCSA) DIRECTIVE D-E3 070801 7	Electrical Operating Permit Requirements
TSBC (BCSA) DIRECTIVE D-EL 2017-01	Exemptions to Utilities
TSBC (BCSA) INFORMATION BULLETIN IB-EL 2017-04	Electrical Safety Regulation Application to Public Utilities
FORM 11 June 2002	Statement to BC Hydro Regarding Primary Voltage Service Entrance Equipment
ELECTRIC SERVICE AGREEMENT	BC Hydro Electric Service Agreement
SIGNAGE	"No Storage Allowed"
ES64 C-03.06	BC Hydro Distribution Inspection and Maintenance Standard Dual Radial Vault Inspection/Maintenance Certification
ES43 J7-01	Primary Revenue Metering Three-Phase Four Wire
ES43 J7-02	Primary Revenue Metering at Customer's Platform for 7.2/12.5 kV & 14.4/25 kV
ES43 R3-05	Bonding and Grounding Equipment Three-Phase Primary Metering
ES43 R3-11	Bonding and Grounding Equipment List of Components
ES54 S3-01	Primary Services Dead-Front Outdoor Type Kiosk Private Property Installation
ES54 S3-02	Primary Services Live-Front Outdoor Type Kiosk Private Property Installation
ES54 S3-03	Primary Services Live-Front Indoor Type Switchgear Private Property Installation
WARNING PLATE	BC Hydro Primary Service Cable Marker Plate
ES54 E6-01	BC Hydro Switchgear Vault in Customer-Owned Building Single Radial Supply
ES54 E6-02	BC Hydro Switchgear Vault in Customer-Owned Building Dual Supply

Primary Service Connections



TSBC (formerly BCSA) DIRECTIVE D-E3 090313 1 High Voltage Installations

DIRECTIVE

No: D-E3 090313 1

HIGH VOLTAGE INSTALLATIONS

This Directive is being issued by a Provincial Safety Manager pursuant to section 30 of the Safety Standards Act. Stakeholders should consult with local authorities having jurisdiction prior to undertaking work, to determine local requirements.

Date of Issue: March 13, 2009

Scope

1. This directive provides guidance on the interpretation and application high-voltage installations operating, or designed to operate, in excess of 750V.
2. Utilities exempted from regulation by Electrical Safety Regulations Section 3 are not bound by this directive. This includes any work done on behalf of the Utility, when the contract is direct with the Utility, and the work is within the scope of the exemption in ESR (3).

Permits

3. All new high-voltage construction requires an installation permit obtained by a licensed contractor with an unrestricted 'A' FSR or restricted 'LI' FSR.
4. All high-voltage installations require an operating permit per Directive D-E3 070801 7 (Electrical Operating Permit Requirements) prior to energization. Installations that have a Utility take-over agreement do not require an operating permit.
5. If approved by variance, an operating permit with a 'B' class FSR is acceptable to operate the high-voltage equipment if that installation is a minor portion of the installation covered by the permit. In this case, maintenance or alteration of high-voltage equipment must be done by a licensed 'A' contractor under a separate permit.

Plans, Specifications, and Service Reports

6. Any plans and specifications required to be submitted must be approved by a Professional Engineer in good standing with the Association of Professional Engineers and Geoscientists of BC.
7. Plans and specifications may not be required to be submitted for installations being built under an approved variance for Utility take-over.
8. As per Directive D-E3 070302 3 (Section 2—General Rules), the following plans and specifications must be submitted with the permit application to the authority having jurisdiction:
   a) A one-line diagram of the installation from the utility connection to the main low voltage distribution point, including connections to any alternate power sources;
   b) Transformer ratings and ratios;
   c) Conductor types and sizes;
   d) Switch, fuse and circuit breaker ratings;
   e) Fault current levels available at the utility connection and at any low voltage distribution point; as well as any fuse co-ordination documents;
   f) Relay and tripping device settings; and
   g) Grounding system details including station grounds.
   h) Declarations from a Professional Engineer for the suitability of equipment, as outlined below.

88 SIXTH STREET, SUITE 400, NEW WESTMINSTER, BRITISH COLUMBIA, CANADA V3L 5B3
Toll Free: 1-866-566-SAFE (7233) Fax: 604 660-6215 Web Site: www.safetyauthority.ca E-mail: info@safetyauthority.ca

FRM-1126-00 (2007/02/07)

9. Any revisions to plans and specifications ("as built" condition) must be submitted with other related documents (such as service reports, ground resistance tests, equipment acceptance reports) when the final declaration is submitted.

Acceptance of High-Voltage Equipment

10. High-voltage equipment will be accepted for service if:
    a) it bears an approval mark issued by an accredited certification or testing agency per Electrical Safety Regulations section 21(1);
    b) it is for privately built installations intended for Utility take-over; or
    c) it is declared to be suitable for the intended use by a Professional Engineer in good standing with the Association of Professional Engineers and Geoscientists of BC if:
        i) no approval program is available from an accredited certification agency;
        ii) the equipment is of a design that can be installed according the BC Electrical Code
        iii) the equipment is designed, built, and tested to the applicable CAN or CSA standard(s), where such a standard exists;
        iv) the equipment is labelled in accordance with Rule 2-100, except for the approval mark required in 2-100(l); and,
        v) specifications for the equipment have been submitted with the permit application.
11. For equipment accepted for service through a declaration by a Professional Engineer and installed at a specific location under an installation or operating permit, an approval label may not be required if a variance has been obtained per Safety Standards Act s. 32.
12. For equipment accepted for service through a declaration by a Professional Engineer but not installed at a specific location under permit, a BC Safety Authority Equipment Approval Label may be applied to the equipment. Requests for this service must be submitted on an "Electrical Product Approval" form.
13. Consumer high-voltage service entrance and protective equipment connected to the Utility system must be acceptable to the Utility.

Overhead Lines

14. Overhead lines are normally constructed to CEC Part III rules, as well as any applicable BC Electrical Code requirements. Information Bulletin **B-E3 090312 1** provides information that may assist in the design and construction of overhead lines, whether operating at high or low voltage.
15. Private high-voltage overhead lines are required to have a disconnecting means with overcurrent protection, in accordance with Rule 36-204, at the point of connection to the utility.
16. Private high-voltage installations connected to the Utility must be acceptable to the Utility.

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FRM-1126-00 (2007/02/07)

Utility Take-over

17. Privately built installations intended for Utility take-over may be exempted from some requirements of the BC Electrical Code, including submission of plans, specifications, and service reports, if, prior to construction,
    a) an installation permit exists, and
    b) a variance has been granted. The variance request must include a copy of the Take-over Agreement, approved by the Utility, including the effective date for take-over, and any conditions for take-over.
18. Privately built installations intended for Utility take-over shall be acceptable to the Utility.

Stephen Hinde
Provincial Safety Manager, Electrical

References:

Bill 19 – 2003	Safety Standards Act
B.C. Reg. 100/2004	Electrical Safety Regulation
B.C. Reg. 105/2004	Safety Standards General Regulation

For more information on the British Columbia Safety Authority, please visit our web site at:
www.safetyauthority.ca

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FRM-1126-00 (2007/02/07)

TSBC (formerly BCSA) DIRECTIVE D-E3 070801 7 Electrical Operating Permit Requirements

Safety Authority

DIRECTIVE

ELECTRICAL OPERATING PERMIT REQUIREMENTS

Date of Issue: August 1, 2007 **No.: D-E3 070801 7**

Revision Date: May 4 , 2015 **Rev: 01**

This Directive is being issued by a provincial safety manager pursuant to section 30 of the Safety Standards Act.

Scope:
This Directive clarifies provisions of the Safety Standards Act, Safety Standards General Regulation, and the Electrical Safety Regulation with regard to Electrical Operating Permit Requirements for the operation or maintenance of regulated electrical equipment.

References:

Bill 19 – 2003	Safety Standards Act
B.C. Reg. 100/2004	Electrical Safety Regulation
B.C. Reg. 105/2004	Safety Standards General Regulation
IB-EL 2015-03	Information Bulletin

Safety Standards Act

A. Section 28 Operating Permits

(5) A person who holds an operating permit must ensure that individuals who do regulated work under the permit maintain current knowledge of this Act, relevant regulations, relevant directives, relevant safety orders and any other relevant material that the minister makes publicly available.

(6) A person who holds an operating permit must not allow regulated work to be undertaken by persons under the permit unless they are authorized under this Act.

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FRM-1126-04 (2011-10-18)

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Interpretation:

The operating permit holder must ensure that current knowledge is assessed for all individuals who perform electrical work under the operating permit, and that regular training is provided to ensure maintenance of up to date knowledge of the Safety Standards Act, relevant regulations and directives, safety orders and any other relevant materials made available.

Persons who are authorized to perform electrical work under an operating permit must be:

- A licensed electrical contractor, or
- Individuals who meet the requirements under Electrical Safety Regulation, s. 4

Safety Standards General Regulation

B. Section 18 Operating permits:

(1) A person must have an operating permit to do any of the following:

(a) operate a regulated product;

(b) maintain a regulated product.

Interpretation:

Electrical equipment is interpreted as having the same meaning as defined in the BC Electrical Code Regulation;

Electrical equipment is interpreted as including equipment that is subject to installation and maintenance requirements under the BC Electrical Code, and does not include consumer products such as household appliances;

Section 18 of the Safety Standards General Regulation requires an operating permit for the operation or maintenance of electrical equipment. Electrical equipment is interpreted as requiring an operating permit when:

(1) the operation or design of electrical equipment is such that regular or ongoing maintenance is required;

(2) the electrical equipment is operated within Class I, Class II, or Class III hazardous locations;

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(3) the electrical equipment is operated or maintained for emergency service;

(4) the electrical equipment is part of a fire alarm system;

(5) the supply is greater than 250 kVA;

(6) the supply to privately owned equipment, except for high voltage neon signs, is greater than 750 volts; or

(7) the equipment is installed for temporary use and the supply is greater than 5 kVA;

Safety Standards General Regulation

C. Section 19 Responsibilities of operating permit holder

(a) if required under the permit, maintain a log of work performed under the permit;

(b) submit any required declaration confirming compliance with the Act;

(d) if a field safety representative is named in the permit, immediately notify the regulatory authority if the field safety representative ceases to be contracted or employed by the permit holder.

Interpretation:

A declaration is required when requested by a safety officer, or as set out under terms and conditions on a permit.

The notification required under this regulation must be provided, in writing, to the appropriate authority having jurisdiction; an entry must also be made in the permit log.

"immediately" is interpreted as being within 5 working days.

A field safety representative may be an employee, or may be contracted by the owner for the purpose of being named on the operating permit.

Safety Standards General Regulation

D. Section 19.1 Regulated work under a permit

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(2) For the purposes of section 23 (1) (a) of the Act, a person who holds a permit is authorized to manage or direct individuals doing regulated work under the permit.

Interpretation:

An operating permit holder may only manage or direct individuals doing electrical work under the electrical operating permit or under an installation permit that has been issued to the operating permit holder.

Individuals who perform electrical work under an electrical operating permit must meet the requirements for supervision under Safety Standards General Regulation, Section 5, and requirements for individuals who may do electrical work under Electrical Safety Regulation, Section 4.

Individuals who perform electrical work under an electrical installation permit issued to the operating permit holder, must also meet the requirements under Electrical Safety Regulation, Section 12.

Safety Standards General Regulation

E. Section 19.1 Regulated work under a permit

(3) For the purposes of section 23 (1) (b) of the Act, a person who is authorized under the Act to do regulated work may do the regulated work for a person who holds a permit.

Interpretation:

This Section is interpreted as allowing the operating permit holder to name a field safety representative employed by a licensed electrical contractor on the operating permit.

Where a licensed electrical contractor is used to provide the field safety representative on the permit, no other licensed electrical contractor may perform electrical work under the operating permit, unless authorized under terms and conditions of the permit, or under a variance.

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BC Electrical Code Regulation

F. Rule 2-010 Posting of permit

A copy of the permit shall be posted in a conspicuous place at the work site and shall not be removed until the inspection has been completed.

Interpretation:

A copy of the operating permit must be posted in a conspicuous place at each structure or facility authorized under the scope of the operating permit.

BC Electrical Code Regulation

G. Rule 2-300 General requirements for maintenance and operation:

(1) All operating electrical equipment shall be kept in safe and proper working condition.

(2) Electrical equipment maintained for emergency service shall be periodically inspected and tested as necessary to ensure its fitness for service.

Interpretation:

The term "operating electrical equipment" is interpreted as including any electrical equipment that is energized or connected to an electrical supply.

The requirement to keep operating electrical equipment in safe and proper working condition is interpreted as requiring maintenance to be performed.

Maintenance work on electrical equipment may also include:

(1) Replacement of existing equipment with equipment that is intended to perform the same function, and

(2) Installation, relocation, and alteration of electrical equipment under the following conditions:

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a. the work may not result in a change in the main service capacity; and

b. additional loads or additional distribution capacity may only be added to existing plant structures, systems, and assemblies; and

c. additional loads may not exceed 12.5 kVA, per installation, in facilities where the main electrical service is rated 250 kVA or less; or

d. additional loads may not exceed 36 kVA, per installation, in facilities where the main electrical service is rated over 250 kVA.

(3) Load calculations demonstrating that any added loads do not exceed the rating of existing service equipment must be entered into the permit log.

Ulrich Janisch
Provincial Safety Manager - Electrical

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TSBC (BCSA) DIRECTIVE D-EL 2017-01 - Exemptions to Utilities

TECHNICAL SAFETY BC

DIRECTIVE

EXEMPTIONS TO PUBLIC UTILITIES

Date of Issue: November 16, 2017 **No: D-EL 2017-01**

This Directive is being issued by a provincial safety manager pursuant to section 30 of the Safety Standards Act.

References:
SBC 2003 Chapter 39 Safety Standards Act
B.C. Reg. 100/2004 Electrical Safety Regulation
Bulletin IB-EL 2017-04 Electrical Safety Regulation Application To Public Utilities

Scope

This directive provides guidance on the interpretation and application of the Electrical Safety Regulation in respect of electric power utilities.

ELECTRICAL SAFETY REGULATION* S. 3 *APPLICATION TO PUBLIC UTILITIES:

(1) This regulation, except for section 3.1, does not apply to a public utility as defined in the Utilities Commission Act in the exercise of its function as a utility with respect to the generation, transmission and distribution of electrical energy.

(2) Despite subsection (1), this regulation applies to the electrical equipment owned or in the possession or control of a public utility if the electrical equipment is not used directly in the generation, transmission and distribution of electrical energy.

Interpretation

The *Electrical Safety Regulation* applies to electrical equipment at facilities; buildings; structures; plants; and projects that are owned by, or in the possession or control of, a public utility when the equipment is not used in the exercise of the public utility's function with respect to the generation, transmission, and distribution of electrical energy.

A. Except where an exemption has otherwise been provided by regulation, an electrical installation or operating permit is required when:
   (a) The equipment is not owned or in the possession or control of a public utility, as defined in the *Utilities Commission Act*;

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(b) Public utility owned electrical equipment is installed within electrical systems that do not form part of its function as a public utility with respect to generation, transmission, and distribution of electrical energy;

(c) A public utility performs electrical work on electrical systems that do not form part of its function as a public utility with respect to generation, transmission, and distribution of electrical energy; and

(d) The primary function of utility owned electrical equipment within a facility is not directly related to generation, transmission, or distribution of electrical energy, in its function as a utility.

B. Electrical equipment that is installed for the sole purpose of serving utility generation, transmission, or distribution equipment to meet a utility standard or requirement is interpreted as forming part of the function of the utility and is therefore included under the Section 3(1) exemption.

C. Installation or alteration of electrical equipment does not require an electrical permit if:
(a) The work is performed under a contract or written agreement with the public utility;

(b) The agreement between the utility and its service provider clearly establishes:

(i) utility supervision and control over design and installation; and

(ii) utility ownership or control of all electrical equipment and plants upon completion of the project

(c) The installation of the electrical equipment is designed and implemented as an extension or upgrade of the utility infrastructure; and

Connection of an electrical supply does not occur until the utility has assumed full ownership or control of all installed electrical equipment.

Ulrich Janisch
Provincial Safety Manager - Electrical

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TSBC (BCSA) INFORMATION BULLETIN IB-EL 2017-04 Electrical Safety Regulation Application to Public Utilities

TECHNICAL SAFETY BC

INFORMATION BULLETIN

ELECTRICAL SAFETY REGULATION APPLICATION TO PUBLIC UTILITIES

Date of Issue: November 16, 2017 **No: IB-EL 2017-04**

This Information Bulletin is being issued by a provincial safety manager pursuant to section 30 of the Safety Standards Act.

References:
B.C. Reg. 100/2004 Electrical Safety Regulation, Section 3
Directive D-EL 2017-01 Exemptions to Public Utilities

Scope
This information bulletin provides guidance on the interpretation and application of the Electrical Safety Regulation (ESR) in respect to the electric power utilities' customer service connections.

Introduction

The exemption under Section 3(1) of the *Electrical Safety Regulation* does not specifically cover varying scopes of electrical installations on private property associated with evolving configurations of customer utility supply service connections. Historically, electric utilities in British Columbia have required utility customers to supply, install and maintain all material and equipment as customer owned infrastructure for customer service connection. Accordingly, this work has historically not been considered as being exempted under ESR, s. 3(1). Changes to utility practices and requirements for utility connections have often resulted in confusion by designers, installers, and inspection authorities, regarding the delineation between regulated and exempted electrical work, and a lack of clarity regarding the appropriate design and installation standard to be applied. These conditions resulted in a review with respect to this work and its relationship to the exemption. Directive D-EL 2017-01 and this bulletin are intended to establish clarity on the demarcation point for regulated electrical work that requires a permit and work on customer owned infrastructure for the purpose of utility distribution of electrical energy that comprise utility exemption per Electrical Safety Regulation Section 3.

Utility Requirements

Based on applicable utility standards, the customer shall supply all ducting for the utility supply conductors, pull boxes and cable pull pits. Moreover, in the past few decades utilities required customers to provide highly prepared switchgear rooms and transformer alcoves to facilitate the installation of utility owned equipment inside customer owned buildings. This requirement evolved in response to certain zoning bylaw changes, which allowed zero clearance building development to the property line.

Most recently, electrical utilities are implementing engineered grounding standards, which require equipotential bonding for exposed pad-mounted equipment, as the most effective means for ensuring public safety. Accordingly, the utility requires its customers supply, install and maintain customer owned

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grounding, bonding and gradient control conductors associated with the utility high voltage distribution equipment placed on private property and inside customer owned buildings.

Electrical utility infrastructures (utility owned, and customer owned and maintained) are built to the applicable utility standards, inspected by the utility inspectors, and utility assumes liability for design, installation, operation and public safety.

The confines and demarcation of Section 3(1) utility exempt infrastructure are defined by utility civil and electrical drawings associated with specific site installations and are restricted to infrastructure directly related to the exercise of its function as a utility with respect to the generation, transmission and distribution of electrical energy.

A. For illustration purposes, examples of typical exempted utility service connections are provided in Appendix A.

Ulrich Janisch
Provincial Safety Manager - Electrical

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TABLE A.1

Utility Service	Service Type	Electrical work exempted under ESR, s. 3(1) and built to utility standard(s).	Electrical work requiring a permit, and compliance with BC Electrical Code.
Primary Services - Overhead Utility Supply	**Utility O/H line supply to customer owned O/H primary service line**	Utility point of connection: Utility cable terminations. (Typically at customer's first pole or H-Frame pole.) Utility work: O/H line utility supply to customer first pole.	Private O/H line construction, load-break switch at first pole, HV grounding, and transformers. Operating permit required upon completion and connection to utility supply, with Class A or Class LI field safety representative. Subject to inspection by Technical Safety BC or local government inspection authority.
	Utility O/H line pole dip to customer owned pad-mounted primary service kiosk	Utility point of connection: Utility cable terminations in cable compartment at customer kiosk. Utility work: O/H line pole dip and ducting on public corridor, customer owned and maintained U/G utility supply ducting on private property.	Installation of customer owned service kiosk, HV grounding, all transformers, equipment and wiring after utility point of connection. Operating permit required upon completion and connection to utility supply, with Class A or Class LI field safety representative. Subject to inspection by Technical Safety BC or local government inspection authority.
	Utility O/H line pole dip to U/G primary service inside customer owned building	Utility point of connection: Utility cable terminations in compartment at customer owned primary service. Utility work: O/H line pole dip and ducting on public corridor, customer owned and maintained U/G utility supply ducting on private property and inside customer building.	Installation of customer owned building HV service, HV grounding, all equipment and wiring after utility point of connection. Operating permit required upon completion and connection to utility supply, with Class A or Class LI field safety representative. Subject to inspection by Technical Safety BC or local government inspection authority.

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TABLE A.2

Utility Service	Service Type	Electrical work exempted under ESR, s. 3(1) and built to utility standard(s).	Electrical work requiring a permit, and compliance with BC Electrical Code.
Primary Services - Underground Utility Supply	**Utility U/G supply to customer owned pad-mounted primary service kiosk**	Utility point of connection: Utility cable terminations in compartment at customer kiosk. Utility work: U/G ducting on public corridor, customer owned and maintained U/G utility supply ducting on private property.	Installation of customer owned primary service kiosk, HV grounding, all equipment and wiring after utility point of connection Operating permit required upon completion and connection to utility supply, with Class A or Class LI field safety representative. Subject to inspection by Technical Safety BC or local government inspection authority.
	Utility U/G supply to customer primary service inside building - Single and Dual Radial Supply	Utility point of connection: Utility cable terminations in compartment at customer building primary service box. Utility work: U/G ducting on public corridor, customer owned and maintained U/G utility supply ducting on private property, customer owned dual radial switches and HV gradient control conductors around dual radial switches.	Installation of customer owned building primary service, dual radial switches for utility use, all HV grounding inside customer building, all equipment and wiring after utility point of connection. Operating permit required upon completion and connection to utility supply, with Class A or Class LI field safety representative. Subject to inspection by Technical Safety BC or local government inspection authority.
	U/G supply to customer primary service inside building – Open Loop Supply	Utility point of connection: Utility cable terminations in compartment at customer building primary service. Utility work: U/G ducting on public corridor, customer owned and maintained U/G utility supply ducting on private property, Open Loop Supply switchgear, HV grounding and precast concrete vaults on public corridors and private property, Switchgear Room inside customer building (customer owned and maintained for BC Hydro exclusive access) including customer owned HV grounding and bonding and cable pull pit.	Installation of customer owned building primary service equipment, HV service grounding, Switchgear Room ancillary equipment, all equipment and wiring after utility point of connection. Operating permit required upon completion and connection to utility supply, with Class A or Class LI field safety representative. Subject to inspection by Technical Safety BC or local government inspection authority.

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TABLE A.3

Utility Service	Service Type	Electrical work exempted under ESR, s. 3(1) and built to utility standard(s).	Electrical work requiring a permit, and compliance with BC Electrical Code.
Secondary Services - Overhead Utility Supply	Single phase 120/240 V secondary service	Utility point of connection: Utility conductor terminations. Typically at customer owned mast(s) O/H drip loops. Utility work: O/H line utility supply to customer owned service mast(s).	Service mast, meter socket and all wiring after utility point of connection, including service grounding and bonding. Operating permit: See directive. Subject to inspection by Technical Safety BC or local government inspection authority.
	Three phase 120/208 V and 347/600 V secondary services	Utility point of connection: Utility conductor terminations. Typically at customer owned mast(s) O/H drip loops. Utility work: O/H line utility supply to customer owned service mast(s).	Service mast, meter socket and all wiring after utility point of connection, including service grounding and bonding. Operating permit: See directive. Subject to inspection by Technical Safety BC or local government inspection authority.

TABLE A.4

Utility Service	Service Type	Electrical work exempted under ESR, s. 3(1) and built to utility standard(s).	Electrical work requiring a permit, and compliance with BC Electrical Code.
Secondary Services - Underground Utility Supply	Single phase 120/240 V service fed from BC Hydro pad-mounted transformer	Utility point of connection: Customer owned meter socket. Utility work: U/G ducting on public corridor, customer owned and maintained U/G utility supply ducting on private property, utility owned transformer, concrete pad, bollards and grounding, customer owned bonding; concrete encasement of duct below meter socket.	Installation of customer owned meter socket, LV service grounding, all LV equipment and wiring after utility point of connection. Operating permit: See directive. Subject to inspection by Technical Safety BC or local government inspection authority.
	Three phase 120/208 V and 347/600 V secondary service fed from BC Hydro PMT	Utility point of connection: Utility cable compartment in customer service box. Utility work: U/G ducting on public corridor, customer owned and maintained U/G utility supply ducting on private property, utility service ducting inside building, utility owned transformer, concrete pad, bollards and HV grounding, customer owned grounding and bonding; concrete encasement of secondary service ducts inside customer building.	Installation of customer owned secondary service box, secondary service grounding, all LV equipment and wiring after utility point of connection by Class B electrical contractor Operating permit: See directive Subject to inspection by Technical Safety BC or local government inspection authority.

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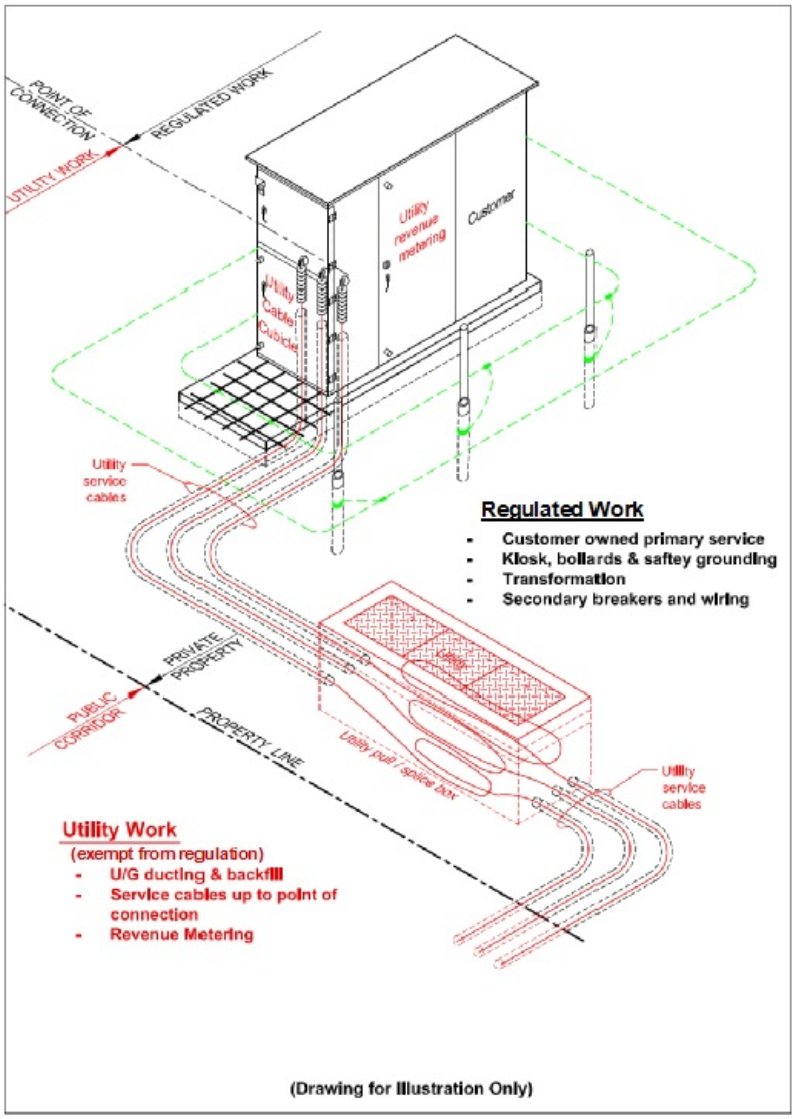

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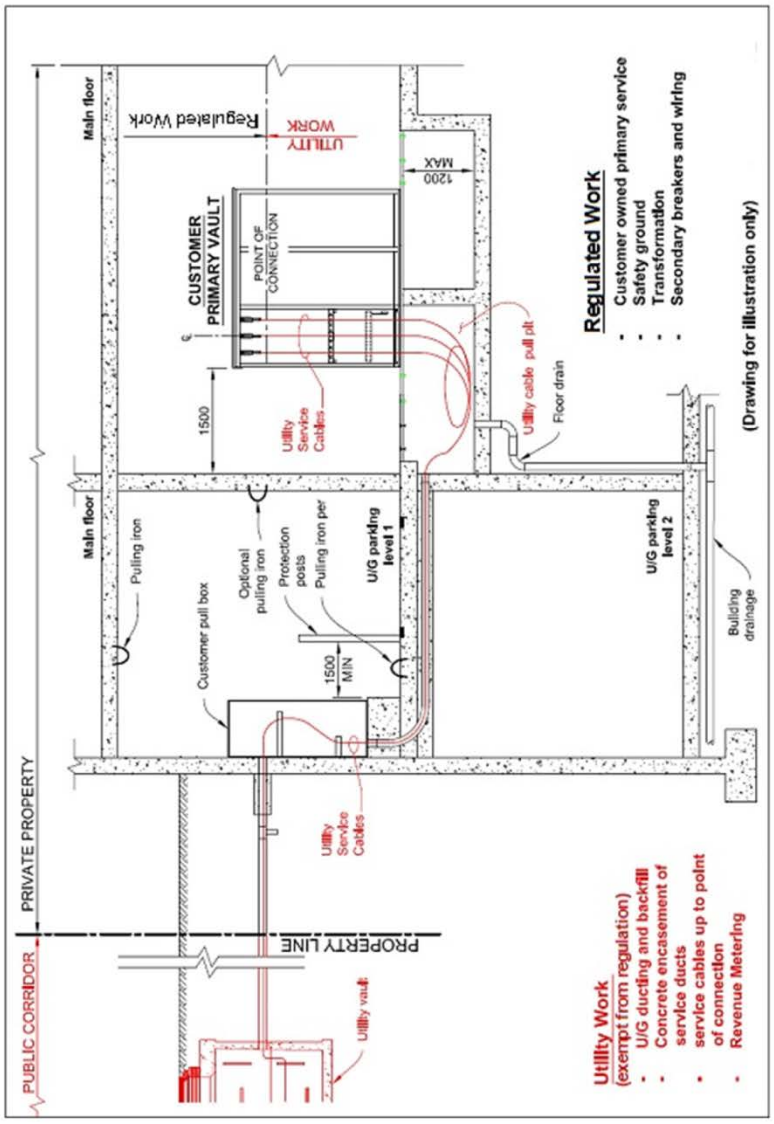

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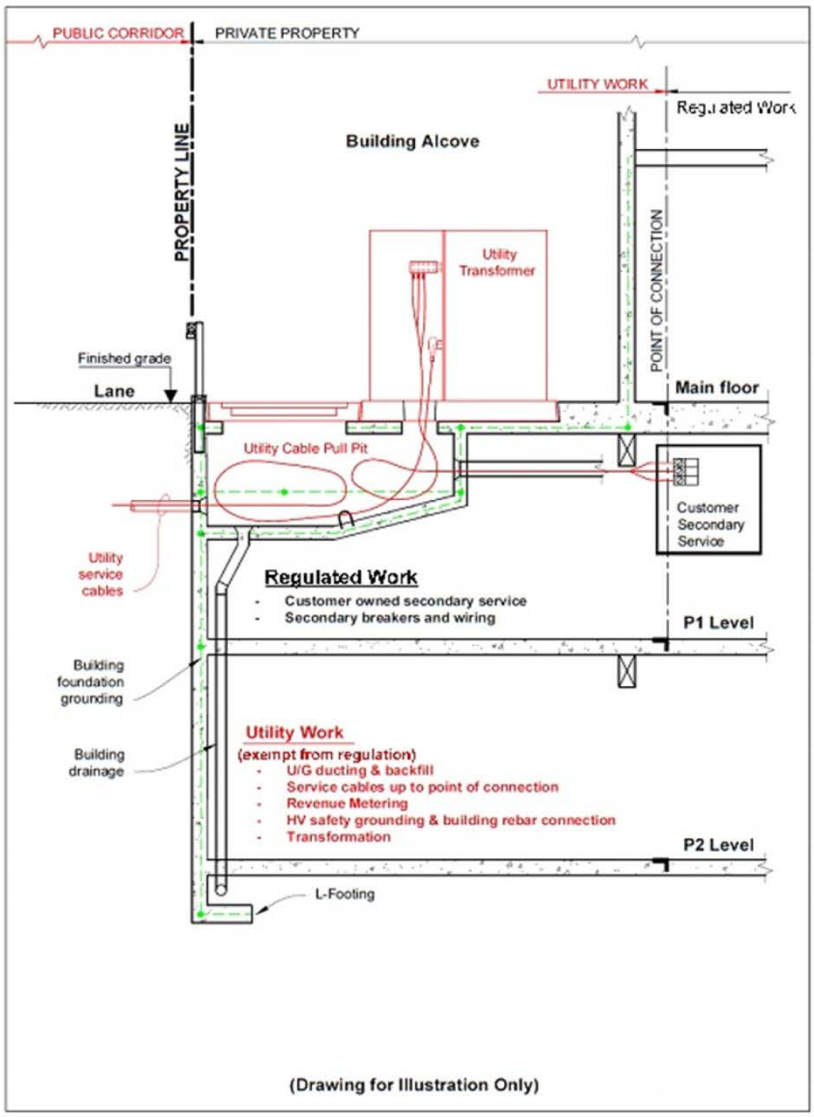

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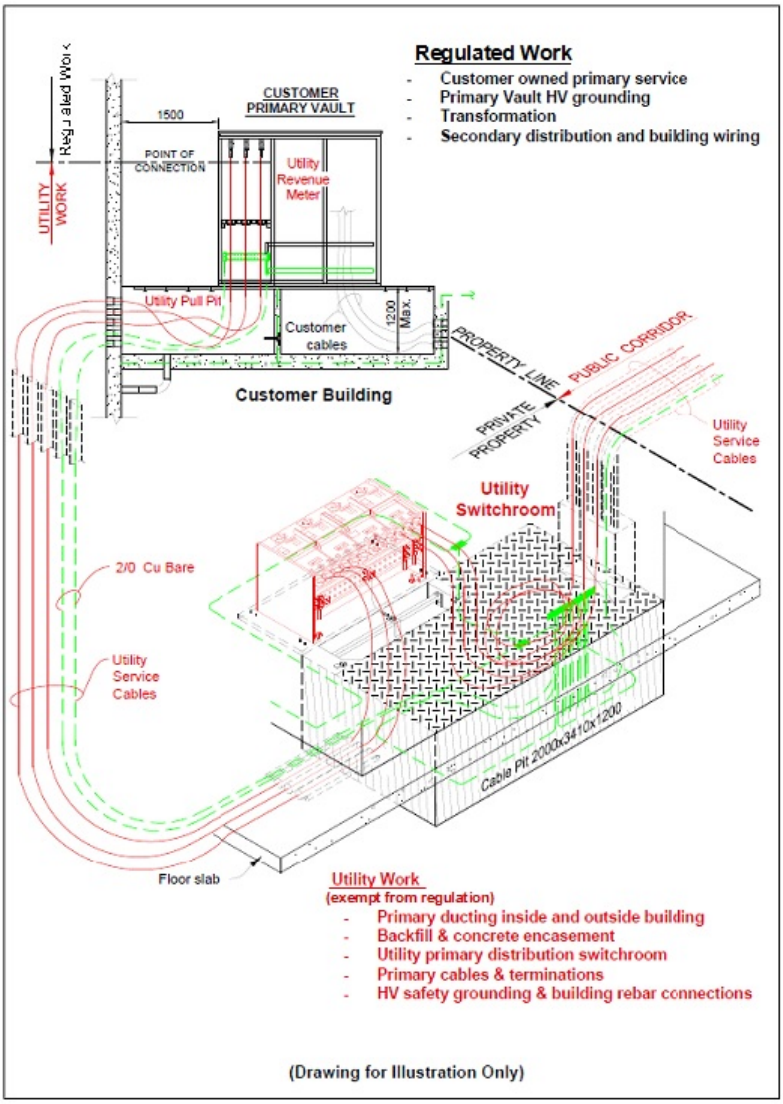

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FORM 11 June 2002 Statement to BC Hydro regarding Primary Voltage Service Entrance Equipment

Statement to BC Hydro Regarding Primary Voltage Service Entrance Equipment

BC hydro

The Customer, or representative, provides this Statement to BC Hydro knowing that BC Hydro intends to rely upon it.

BC Hydro may refuse to supply Electricity to the Customer or suspend or discontinue the supply if, in BC Hydro's judgment, the Equipment is not compatible with or suitable for the BC Hydro electrical system.

The judgment by BC Hydro of the Equipment shall not be construed by the Customer or others as an endorsement of the design or as a warranty by BC Hydro of the Equipment for the purpose of the Customer or others than BC Hydro.

Project	Location	Owner/Developer

Service: U/G ☐ O/H ☐	At kV	Expected Service Date:

Type of Service Equipment: O/H Structure ☐ Unit Sub. ☐ Outdoor ☐ Indoor ☐ Vault ☐

Required Drawings: One-Line Drawing Number _____ Site Plan Drawing Number _____

Equipment Layout Drawing Number _____

Transformers:

Bank kV•A	H.V. Winding				L.V. Winding				High Voltage Taps				On-load Tap Changer ± ____ %	Impedance % ____ on bank kV•A base (ONAN)
	Volts	Δ	Y	Y Grounded	Volts	Δ	Y	Y Grounded	Above Rated Volt. No.	Above Rated Volt. %	Below Rated Volt. No.	Below Rated Volt. %		

Service Entrance: (Complete I or II)

(I) Circuit Breaker:

Voltage Rating kV	Current Rating Amps	Interrupting Rating KA SYM RMS	Clearing Time Cycles	Trip Coil - Current Trip Amps (ac) - or Shunt Trip Volts (dc)

(II) Fuse Protection: Either Load Break Switch, or Disconnect Switch Interlocked with Secondary Breaker.

(A) Switch (Specify Mounting): Pole ☐ Structure ☐ Cubicle ☐

Voltage Rating kV	Load Interrupting Rating Amps	At % P.F.	Momentary Rating Amps	At % P.F.	Manufacturer (if known)	CSA Approval Yes ☐ No. ☐

(B) Fusing

Manufacturer	Manufacturer Type Designation	Rated Continuous Current	Rated Maximum Voltage	Fuse Characteristics

Interconnection Protection:

Protection	Manufacturer	Type/Style	Timed Element Setting Range	Inst. Element Setting Range
Ground Overcurrent				
Phase Overcurrent				
☐ Over ☐ Under Voltage				
☐ Over ☐ Under Frequency				
Synchronizing Check				
Reverse Power				
Differential				
Under Frequency Load Shedding				

Are C.T.'s adequate to operate relays and current trip coils where applicable for all current magnitude from minimum trip to maximum fault duty?

☐ Yes ☐ No based on maximum fault duty of _____ MV•A

Last revised: 11 June 2002
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Sheet 1 of 2

Metering:

			Estimated Maximum Demand		Metered Voltage
Pole Metering.	Yes ☐	No ☐	Initial	Future	
Vault or Indoor Unit Sub.	Yes ☐	No ☐			Rate Schedule
Outdoor or Unit Sub	Yes ☐	No ☐	_____ kW	_____ kW	

Customer Generation:

☐ No Customer generation.

☐ Customer generation not parallel to BC Hydro supply, transfer switch type: _____

☐ Customer generation parallel to BC Hydro supply but with no agreement to sell electricity to BC Hydro.

☐ Customer generation parallel to BC Hydro supply with intent to sell electricity to BC. Hydro.

If selected, complete Generators Section.

Generators:

Type	Energy Source	Manufacturer	Rated Output in kW	Rated Output Voltage	Power Factor	3 PH or 1 PH	Total Harmonic Content Current	Total Harmonic Content Voltage	Reactance in % Machine kV•A Base Xd	Xd'	Xd''	Machine Inertia Constant H

Type: 1. Synchronous Generator 2. Induction Generator 3. Other: _____

Energy Source: 1. Hydraulic 2. Gas 3. Woodwaste 4. Diesel 5. Other: _____

If the above space is insufficient for all generators, please provide remaining generator information separately.

Seal of Professional Engineer

	BC Hydro
Company	
Signature	Received By
Date	Date

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ELECTRIC SERVICE AGREEMENT BC Hydro Electric Service Agreement

BC hydro

ELECTRIC SERVICE AGREEMENT made the _____ day of _____ 201 .

BETWEEN:

_____

_____

_____

GST/HST
Registration # _____

("the Customer")

AND:
British Columbia Hydro & Power Authority

("BC Hydro")

WITNESSES that the Customer and BC Hydro agree as follows:

1. This Agreement covers electrical service to the premises located at

2. The supply of electricity shall be alternating current phase wire, having a frequency of approximately 60 hertz metered at a nominal potential of volts and delivered at a nominal potential of volts at the Point of Delivery, subject to normal variations from the said frequency and voltages.

   ☐ Secondary Metering ☐ Primary Metering

3. The electricity supplied and taken is subject to the terms and conditions of the Electric Tariff of BC Hydro, including the provisions of Schedule , or amendments thereto or replacements thereof, as filed with and approved by the Utilities Commission. The Customer may inspect the Electric Tariff of BC Hydro during normal business hours at BC Hydro's Head Office or its other general offices and such right to inspect is sufficient notice of the terms and conditions and rate schedules contained therein.

4. This agreement shall continue and remain in force from the date the service is first energized. It shall continue unless terminated by either party giving the other not less than thirty days notice in writing, and it shall, upon expiration of the said notice period, so terminate.

5. BC Hydro owns and is responsible for the maintenance of only the following electrical equipment installed or to be installed at the premises.

   (a) Meters and metering transformers for billing purposes.
   (b) BC Hydro transformers *(see list attached)*.
   (c) BC Hydro rental transformers *(see Rental Agreement attached)*.
   (d) span(s) of primary service connection and/or span(s) of secondary service connection.

   BC Hydro is not responsible for the maintenance of any other electrical equipment located at the premises, including such equipment identified as:

6. The load shall not exceed kW of maximum demand without the prior written approval of BC Hydro.

7. The Customer shall either:
   (a) Equip all motors having a rated capacity over hp with reduced voltage motor starters satisfactory to BC Hydro.
   OR
   (b) Be responsible to manage inrush and limit inrush to kVA at any time.

td-elecsvcagmt.doc Last revised: Last revised: 1 July 2010

8. If required, BC Hydro shall construct to its specifications an extension and/or service connection to supply electricity to the Customer for a Net Construction Cost of $. Prior to the commencement of construction the Customer shall pay the following charges, as applicable:

Extension Fee	$
Connect Charge (Dedicated Facilities)	$
Other	$
Net Customer Contribution in Aid of Construction (CIA)	$
Less Customer Contribution in Kind (CIK)	$
Net Customer Cost	$
GST/HST Customer Cost (BC Hydro GST/HST Regist. No. R121454151)	$
Net Customer Payment/Refund	$

9. The Customer shall provide a Guarantee in the amount of $ and in the form of . BC Hydro will hold the Guarantee for a period of years. The amount of the guarantee will be determined by BC Hydro and the maximum amount shall be equal to all or part of BC Hydro's Contribution. At the end of the guarantee period, BC Hydro will re-evaluate BC Hydro's Contribution based on the actual number of Customers and the actual average Billing Demand over the guarantee period. Based on this reevaluation, BC Hydro will return the Guarantee, either in whole or in part, or will return none of the Guarantee. Interest will not be paid on the guarantee.

British Columbia Hydro & Power Authority

ER: _____
Signature

_____
Printed Name

_____
Position

Customer

PER: _____
Signature

_____
Printed Name

_____
Position

The following is for Hydro office use only and does not form part of the Agreement between BC Hydro and the Customer.

Electric Service Agreement

Customer Name		Service Details	Wires	Amps	Volts	Phase	
Service Address							
Mailing Address		Total Charges	Amount $		Receipt No.		
Business Partner Number		Pay As You Go Billing Required?	Yes				
Installation Number			No	Reason			
Contract Account Number				Manager's Approval			
Date Responsible		Rate Schedule					
Electric Service Order No.		Premise Code					
		Nature of Business					
		Issuing Office					

td-elecsvcagmt.doc Last revised: 1 July 2010

BC Hydro No Storage Allowed Sign

ES64-C-03.06 BC Hydro Distribution Inspection and Maintenance Standard Dual Radial Vault Inspection/Maintenance Certification

Appendix B (extract from)

BC HYDRO DISTRIBUTION INSPECTION & MAINTENANCE STANDARD
ES 64-C-03.06 Date 01 FEB 2000

BUILDING VAULTS ON THE DUAL RADIAL SYSTEM

1.0 INTRODUCTION

An inspection and maintenance program is essential to assure the integrity of BC Hydro equipment installed in vaults located in customer buildings, for the safety of BC Hydro personnel and effective system operation. Ongoing and Annual inspection of the equipment is necessary to monitor its condition and provide a report that will specify the remedial action needed to correct deficiencies.

2.0 PURPOSE

This standard outlines minimum inspection and maintenance procedures for BC Hydro owned equipment located in building vaults to provide safe and reliable operation. This standard is to aid and supplement, but not replace the manufacturer's recommended maintenance standard.

3.0 POLICY

Building vaults containing BC Hydro equipment shall be inspected annually while energized and maintenance work performed on a priority system. In an addition, an overhaul of the equipment shall be performed every three years with the vault de-energized. All work shall be performed in accordance with BC Hydro approved safety practices and regulations. All work shall be performed by qualified and authorized workers or contractors. All aspects of inspections and maintenance work performed will be recorded on forms shown on pages 5 through 16

4.0 ONGOING INSPECTION AND ASSESSMENT PROCEDURE

Assessment of vaults are encouraged and completed when B C Hydro employees are performing switching tasks on the dual radial system. A summary Inspection sheet (see Appendix A, page 5) will be filled out whenever remedial action is deemed necessary by employees and/or managers. A copy of the summary Inspection sheet will be used to communicate and follow up deficiencies with customers. The maintenance work to be done will be identified according to the following priority system:

PRIORITY 1

IMMINENT risk items where the work must be reported immediately to BC Hydro's manager and arrangements made to complete this work within 7 days.

PRIORITY 2

URGENT risk items where work must be reported to BC Hydro's manager within 5 days and arrangements made for this work to be completed within 60 days.

PRIORITY 3

ROUTINE risk items, where the work is reported to BC Hydro's manager within 5 days and arrangements made to complete the work within 12 months.

5.0 ANNUAL INSPECTION AND MAINTENANCE PROCEDURE

An annual inspection of dual radial vaults is also necessary. See Appendix B1 and B2, (annual Inspection sheets, pages 6 & 7). A check list inspection system details the specific items to be inspected, the conditions expected, and a results table that identifies maintenance work to be done according to the priority system of section 4.

6.0 ANNUAL INSPECTION AND MAINTENANCE DECAL

Post an inspection/maintenance DECAL adjacent to the switch viewing window. The decal shall measure 2 inches high by 3 inches wide and contain the following;

- inspection date
- next inspection due date
- inspection Company's name
- inspector's name
- previous 3 year maintenance/overhaul date
- vault I D

7.0 MAINTENANCE PROCEDURE EVERY THREE YEARS.

A complete overhaul of BC Hydro owned equipment shall be performed at three year intervals with the equipment de-energized. The checklists on pages 5,through 16, detail the specific items to be maintained. The three year maintenance shall be coordinated to include maintenance work identified in the annual inspection.

8.0 DOCUMENTATION

- all inspection reports will be signed by the inspector of the company performing the work.
- maintenance items requiring additional work will be identified, reported to the BC Hydro manager and prioritized as noted in section 4.
- A duplicate copy of the inspection report shall be placed in a transparent plastic pouch in a conspicuous location inside the vault.
- Where the vault access description has changed, an updated copy of the page 3 vault information shall be placed in the pouch

9.0 RECORDS

A file shall be established for each building vault and contain the information shown on page 3 (vault I D # , address, circuit #, location guide etc.).

Appendix C

Dual Radial Vault Inspection/Maintenance Certification

Vault number	**Property Owner** Name _____ Phone _____	
Building Address	**Property Manager** Name _____ Phone _____	
Date of Last Inspection Completed by	**Contact for Access (24hrs/day)** Name _____ Phone _____ Pager _____	
Date of Last Maintenance/Overhaul Completed by	Running Circuit Completed Date:	Standby Circuit Completed Date:
Date of next planned maintenance		

Signed: _____ Date: _____

Print name: _____

Once complete please fax to: **Bruce Miller**
Project Manager
Dual Radial Vault Maintenance
528-2771

Dual **R**adial **V**ault **I**nspection/**M**aintenance **C**ertification

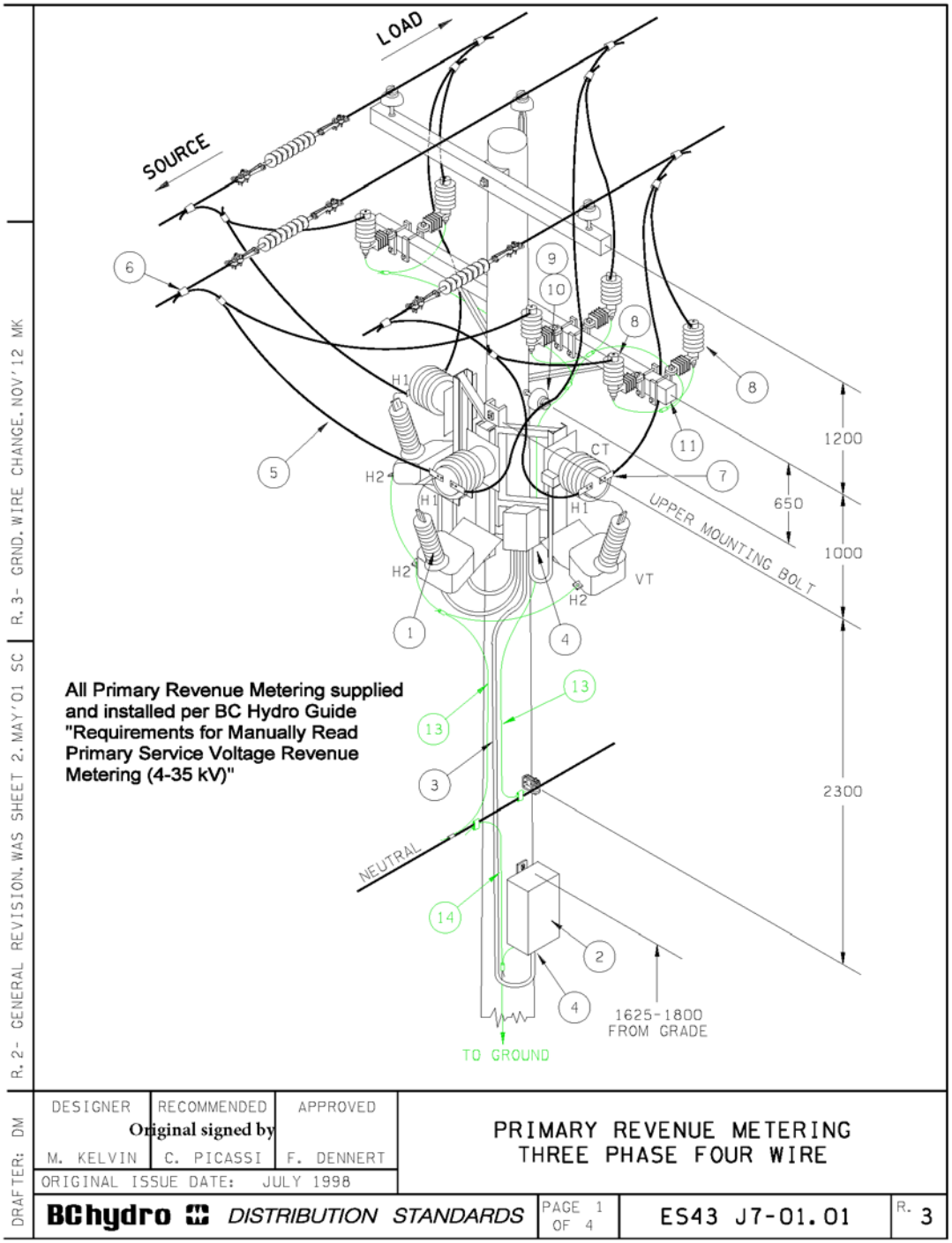
Vault number	Property owner name and phone
Building address	Property manager name and phone
Date of last inspection Completed by Phone	Contact person for access (24 hrs/day)
Running circuit: Date: Worker: Company: Maintenance due	Standby circuit: Date: Worker: Company: Maintenance due

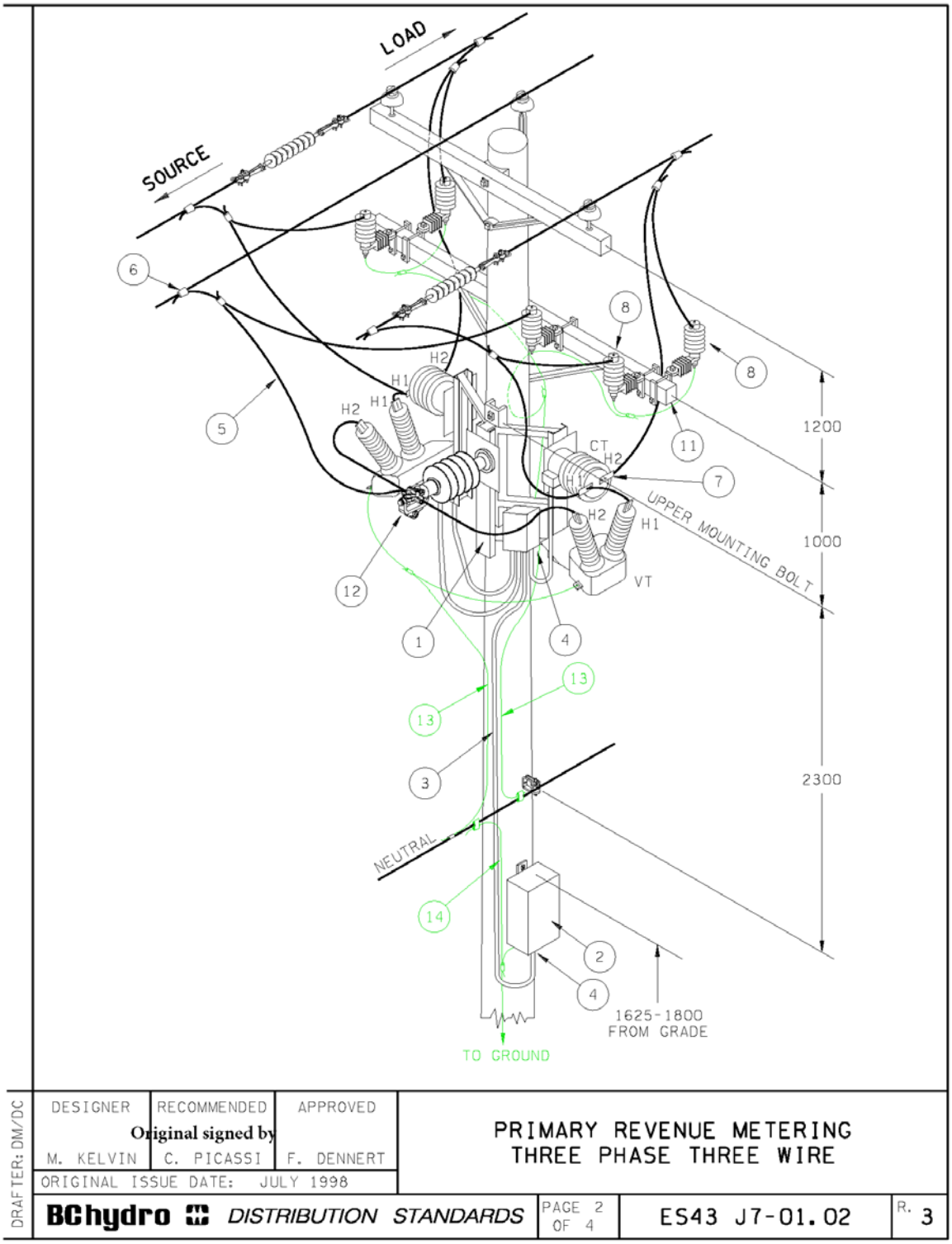
Operations centre tel: (604) 528 2900 or
drvsupport@bchydro.com

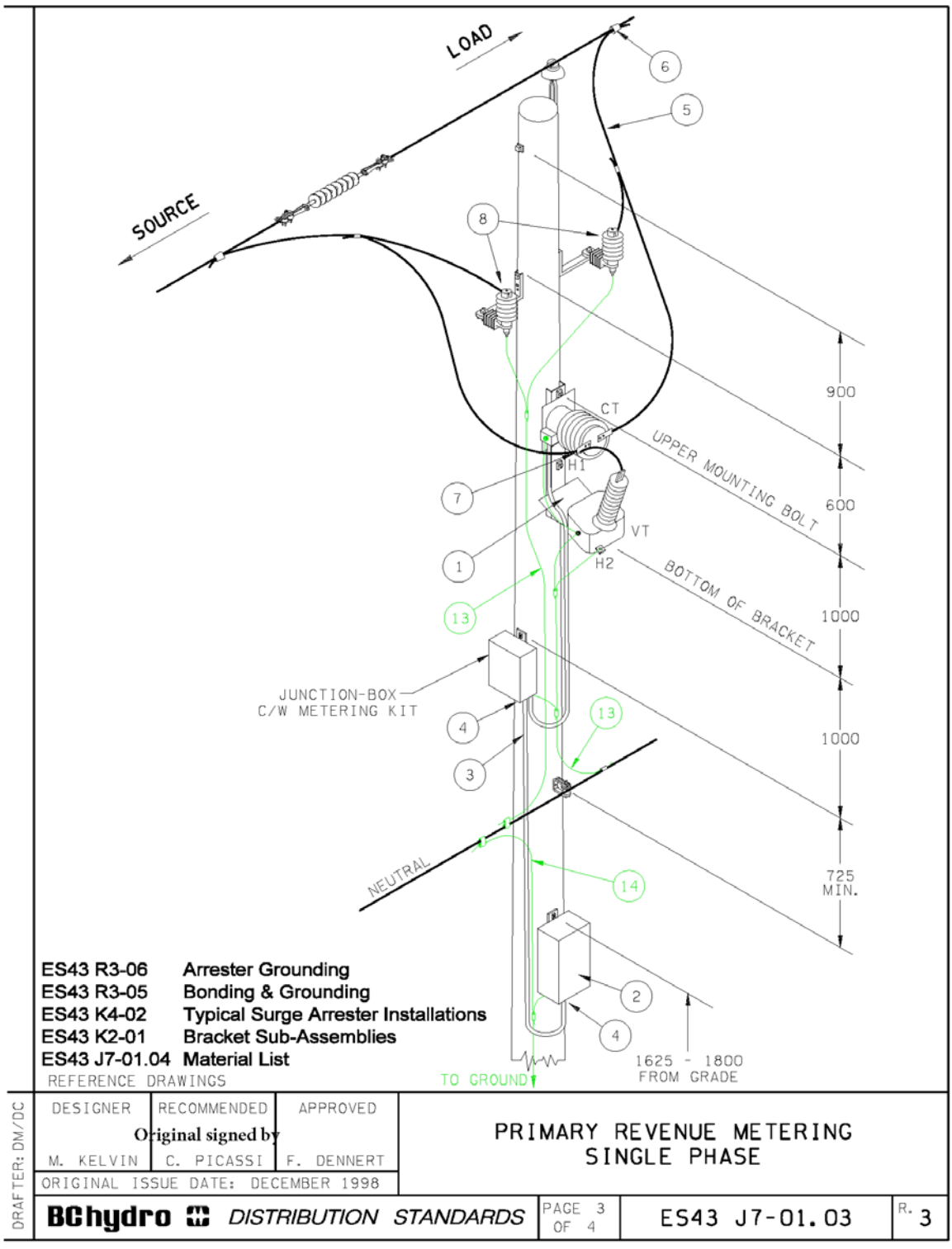
BC Hydro

BCH17-312

ES43 J7-01 Primary Revenue Metering Three Phase Four Wire







ITEM #	DESCRIPTION	STOCK NO.	QUANTITY
1	METERING KIT		1
	25kV class, 3Ph., 4 wire, VT: 14,400-120, CT: 10-5	362-6037	
	25kV class, 3Ph., 4 wire, VT: 14,400-120, CT: 25-5	362-6330	
	25kV class, 3Ph., 4 wire, VT: 14,400-120, CT: 50-5	362-6039	
	25kV class, 3Ph., 4 wire, VT: 14,400-120, CT: 100-5	362-6031	
	25kV class, 3Ph., 4 wire, VT: 14,400-120, CT: 200-5	362-6032	
	25kV class, 3Ph., 4 wire, VT: 14,400-120, CT: 300-5	362-6033	
	25kV class, 3Ph., 4 wire, VT: 14,400-120, CT: 400-5	362-6034	
	15kV class, 3Ph., 4 wire, VT: 7,200-120, CT: 10-5	362-5037	
	15kV class, 3Ph., 4 wire, VT: 7,200-120, CT: 25-5	362-5330	
	15kV class, 3Ph., 4 wire, VT: 7,200-120, CT: 50-5	362-5039	
	15kV class, 3Ph., 4 wire, VT: 7,200-120, CT: 100-5	362-5031	
	15kV class, 3Ph., 4 wire, VT: 7,200-120, CT: 200-5	362-5032	
	15kV class, 3Ph., 4 wire, VT: 7,200-120, CT: 300-5	362-5033	
	15kV class, 3Ph., 4 wire, VT: 7,200-120, CT: 400-5	362-5034	
	15kV class, 3Ph., 3 wire, VT: 12,500-120, CT: 400-5	Contact RMSM	
	25kV class, 1Ph., 2 wire, VT: 14,400-120, CT: 10-5	362-6117	
	25kV class, 1Ph., 2 wire, VT: 14,400-120, CT: 25-5	362-6110	
	15kV class, 1Ph., 2 wire, VT: 7,200-120, CT: 10-5	362-5117	
	15kV class, 1Ph., 2 wire, VT: 7,200-120, CT: 25-5	362-5110	
2	METER CABINET	372-9204	1
3	TECK CABLE		10m
	11 conductor, for 3 ph	380-4545	
	4 conductor, for 1 ph	380-4555	
4	CABLE FITTING		2
	11 conductor, for 3 ph	390-1125	
	4 conductor, for 1 ph	390-1122	
5	POLYETHYLENE COVERED CONDUCTOR		As required
	200 amps and less: #2 Cu	380-0256	
	201 to 400amps: 4/0 Cu	380-0261	
6	AMPACT CONNECTORS		3 Ph 1 Ph
	#2 ACSR TO #2 Cu	388-0531	9 3
	366.4 ASC TO 4/0 Cu	388-0825	
7	COMPRESSION SPADE CONNECTORS		3 Ph 1 Ph
	#2 Cu	388-1030	6 2
	4/0 Cu	388-1035	
8	SURGE ARRESTERS		3 Ph 1 Ph
	9kV rating, for 7.2 / 12.5kV system	351-0013	6 2
	18kV rating, for 14.4 / 25kV system	351-0016	
9	PIN INSULATOR 14.4 / 25kV	410-0649	1
10	DROP LEAD INSULATOR PIN	421-0311	1
11	9' CROSS ARM	421-0022	1
12	INSULATOR, HORIZONTAL LINE POST, 25kV	410-0681	1
13	#4 AWG PE COVERED Cu CONDUCTOR	380-5051	As required
14	THEFT DETERRENT GROUNDING WIRE	96006427	As required

DRAFTER: DM

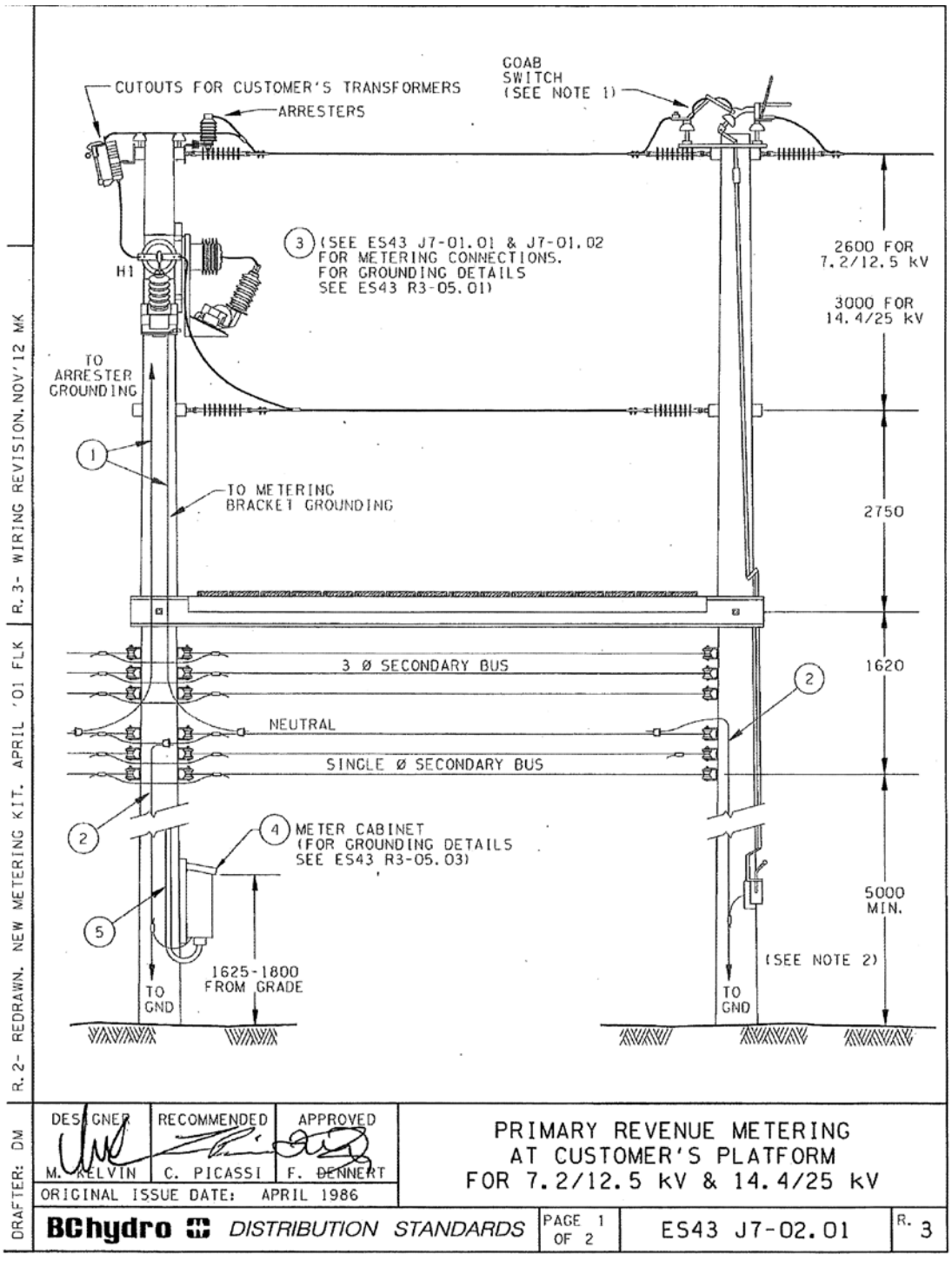
DESIGNER	RECOMMENDED	APPROVED
M. KELVIN	Original signed by C. PICASSI	F. DENNERT

ORIGINAL ISSUE DATE: JUNE 2001

PRIMARY REVENUE METERING
BILL OF MATERIAL

BCHydro DISTRIBUTION STANDARDS | PAGE 4 OF 4 | ES43 J7-01.04 | R. 3

ES43 J7-02 Primary Revenue Metering at Customer's Platform for 7.2/12.5 kV & 14.4/25 kV



NOTES:

1. Customer's platform and accessories shown are typical only. If maintenance is done by BC Hydro, GOAB switch may be omitted and structure must comply with BC Hydro Standards.
2. Customer owned GOAB switch shall comply to CEC Part 1 Section 36 and include safety ground mat per ES43 R3-07.

Item	Description	Catalogue ID	Quantity
1	#4 AWG PE Covered Cu Conductor	380-5051	As Required
2	Theft Deterrent Grounding Wire	96006427	As Required
3	Metering Kit (see ES43 J7-01.04)	BCH	1
4	Metering Cabinet (see ES43 J7-01.04)	372-9204	1
5	Teck Cable II Conductor for 3 Ph Metering	380-4545	1

"BCH Requirements for Manually Read Primary Service Voltage Revenue Metering (4-35 kV)"
ES43 R3-06 Surge Arrester Bonding & Grounding
ES43 R3-05 Metering Kit Bonding & Grounding
ES43 K2-01 Cutout & Arrester Mounting
ES43 J7-01.01 Three Phase Primary Metering
REFERENCE DRAWINGS

DRAFTER: DM

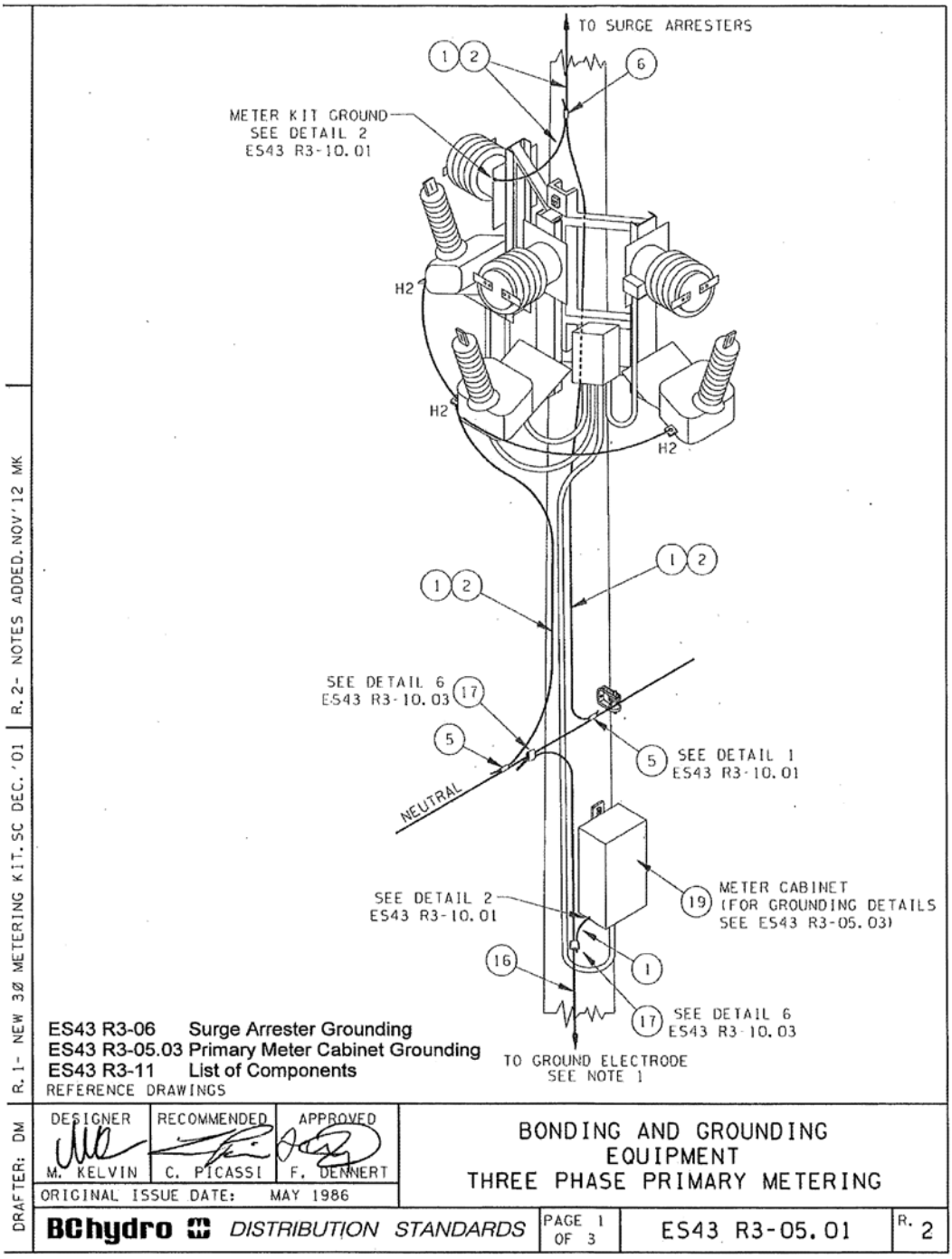
DESIGNER	RECOMMENDED	APPROVED
M. KELVIN	C. PICASSI	F. DENNERT

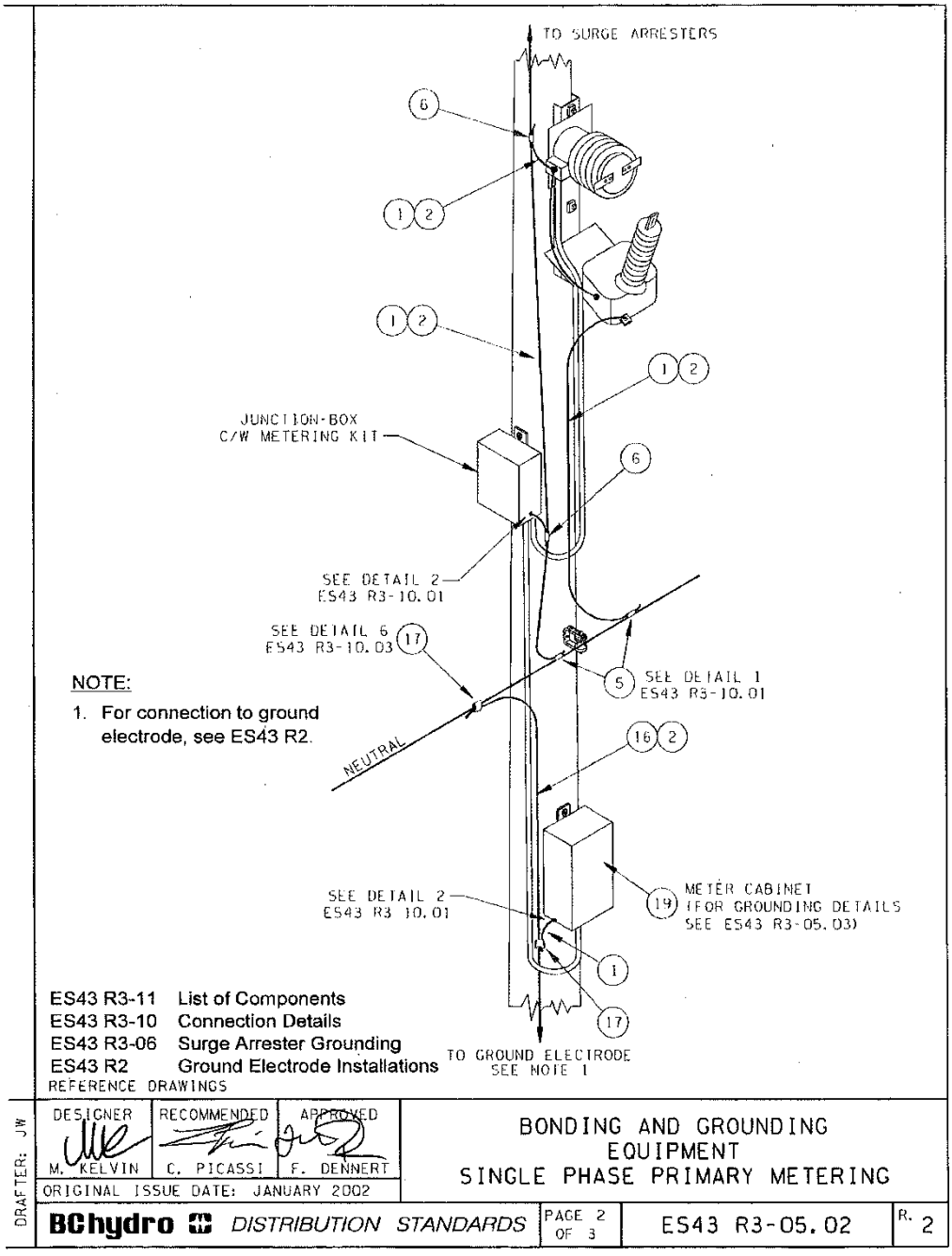
ORIGINAL ISSUE DATE: DECEMBER 2010

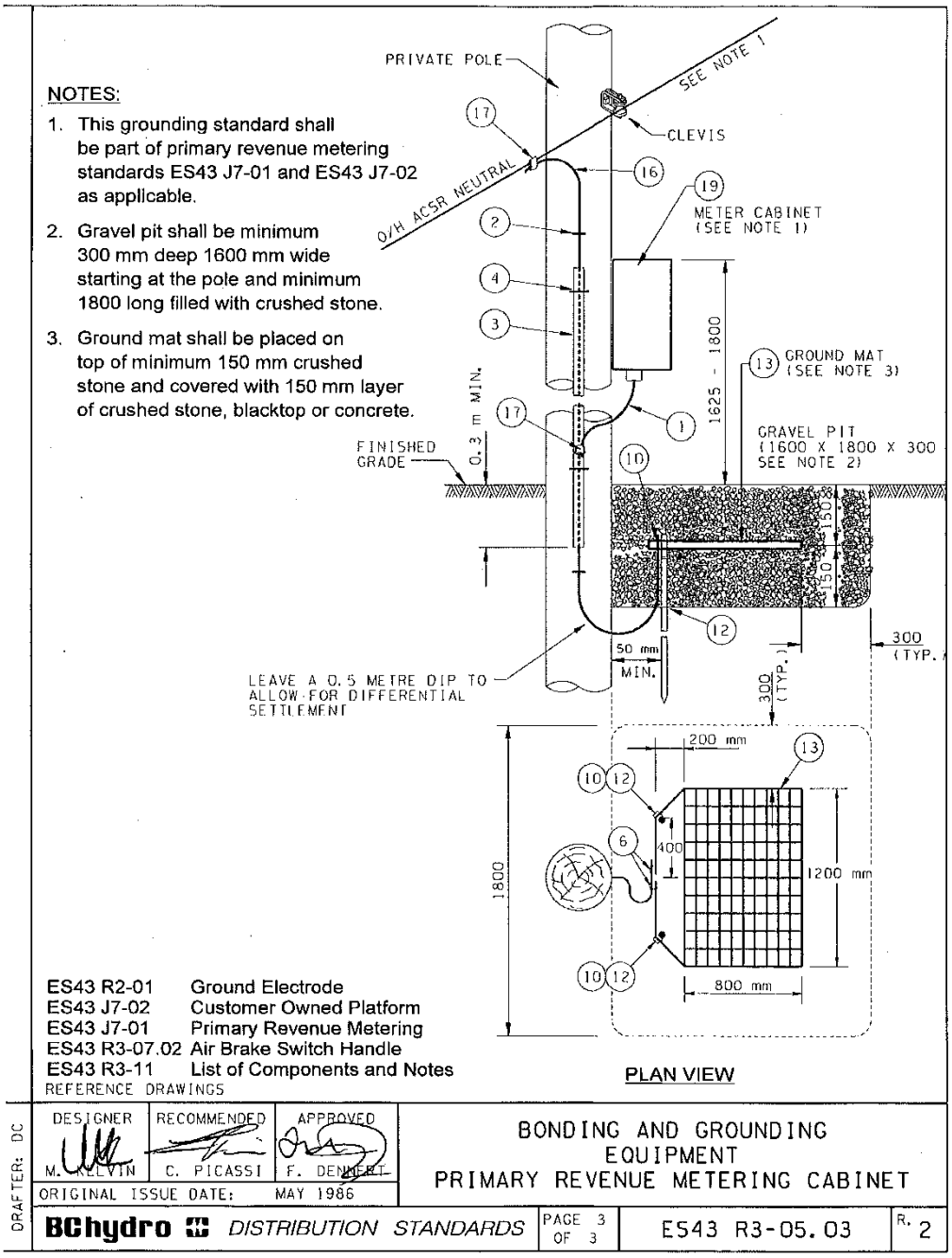
REVENUE METERING
PRIMARY - AT CUSTOMER'S PLATFORM
BILL OF MATERIAL & NOTES

BCHydro DISTRIBUTION STANDARDS | PAGE 2 OF 2 | ES43 J7-02.02 | R. 3

ES43 R3-05 Bonding and Grounding Equipment Three-Phase Primary Metering







ES43 R3-11 Bonding and Grounding Equipment List of Components

LIST OF COMPONENTS

Item No.	Description	Catalogue ID
1	#4 Awg Cu Gnd.Conductor P. E. Covered	380-5051
2	Staple, Ground Conductor	103-0224
3	Moulding, Ground Conductor	388-5221
4	Staple, Conductor Moulding	103-0228
5	Compression Connector H-Type	388-0514
6	Compression Connector C-Type	388-0453
7	Split Stud Connector	388-2103
8	3/8" Nut, Hex, Galvanized	102-0122
9	3/8" Washer, Spring, Galvanized	102-4154
10	Ground Rod/Ground Wire Connector	420-1158
11	Ground Rod/Counterpoise Connector	420-1157
12	Ground Rod	420-1093
13	Ground Mat (800 mm x 1200 mm)	350-8810
14	Wire Rope Counterpoise (7 m)	106-2510
15	U-Bolt Clamp	420-0965
16	Theft Deterrent Galvanized Grounding Wire	96006427 or 96006428
17	Miniwedge, Erico	96006696, 96006695, or 96006667 as per ES43 R2-01
18	1/2" Split Stud Connector	97000053
19	Meter Cabinet	372-9204

PROFESSIONAL ENGINEER PROVINCE OF BRITISH COLUMBIA C. C. PICASSI # 35692 Oct 27/14

ES43 R3-10 Connection Details
ES43 R2-01 Ground Electrode Installations
REFERENCE DRAWINGS

DRAFTER: DC

R. 2- ITEM 16, 17, 18 & 19 ADDED. NOV'12 MW | R. 3- ITEM 18 UPDATED. NOV'14 MS

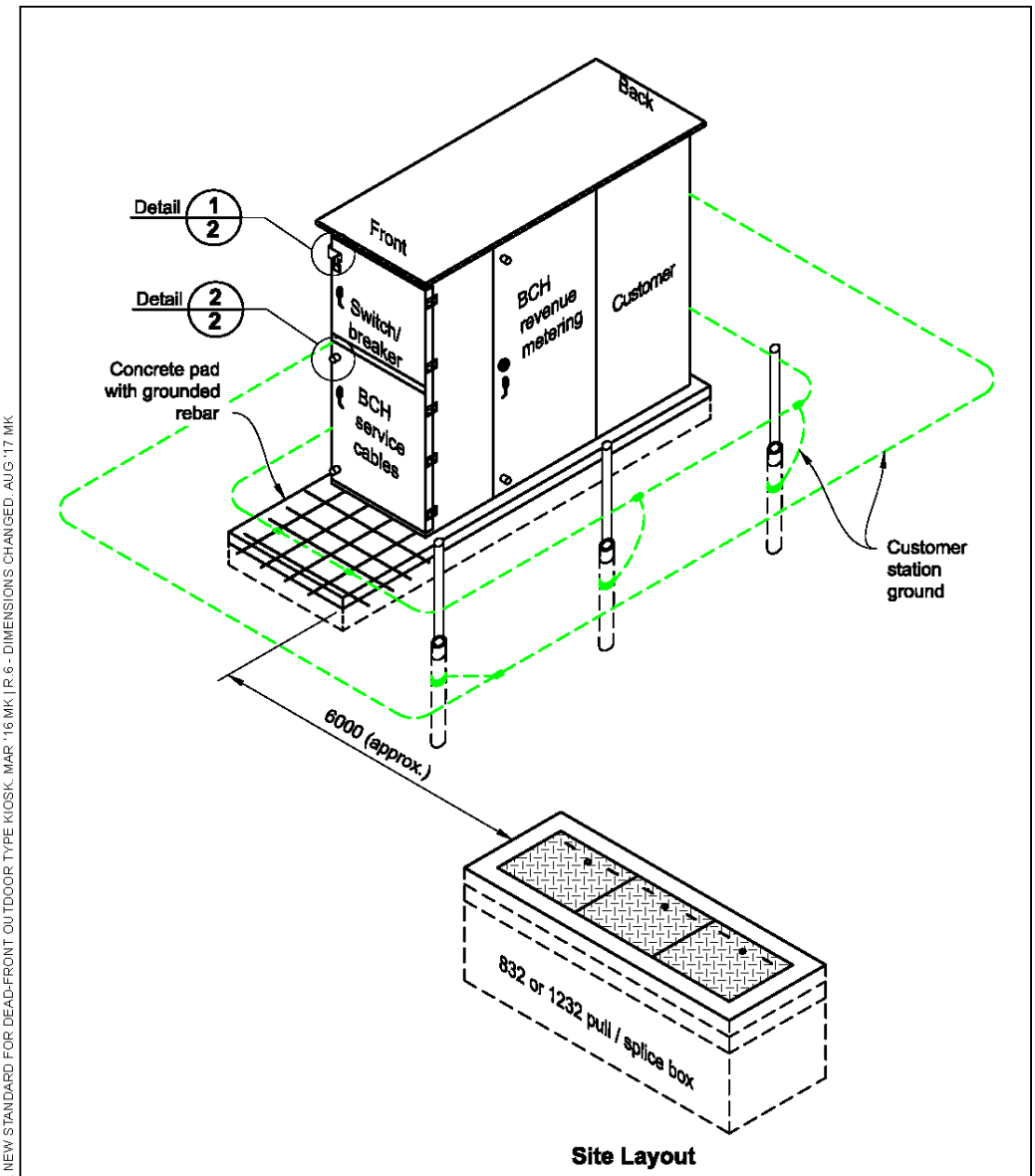
DESIGNER	RECOMMENDED	APPROVED
M. SCHAEFER	C. PICASSI	F. DENNERT

ORIGINAL ISSUE DATE: MAY 1986

BONDING AND GROUNDING EQUIPMENT LIST OF COMPONENTS

BChydro DISTRIBUTION STANDARDS | PAGE 1 OF 1 | ES43 R3-11 | R. 3

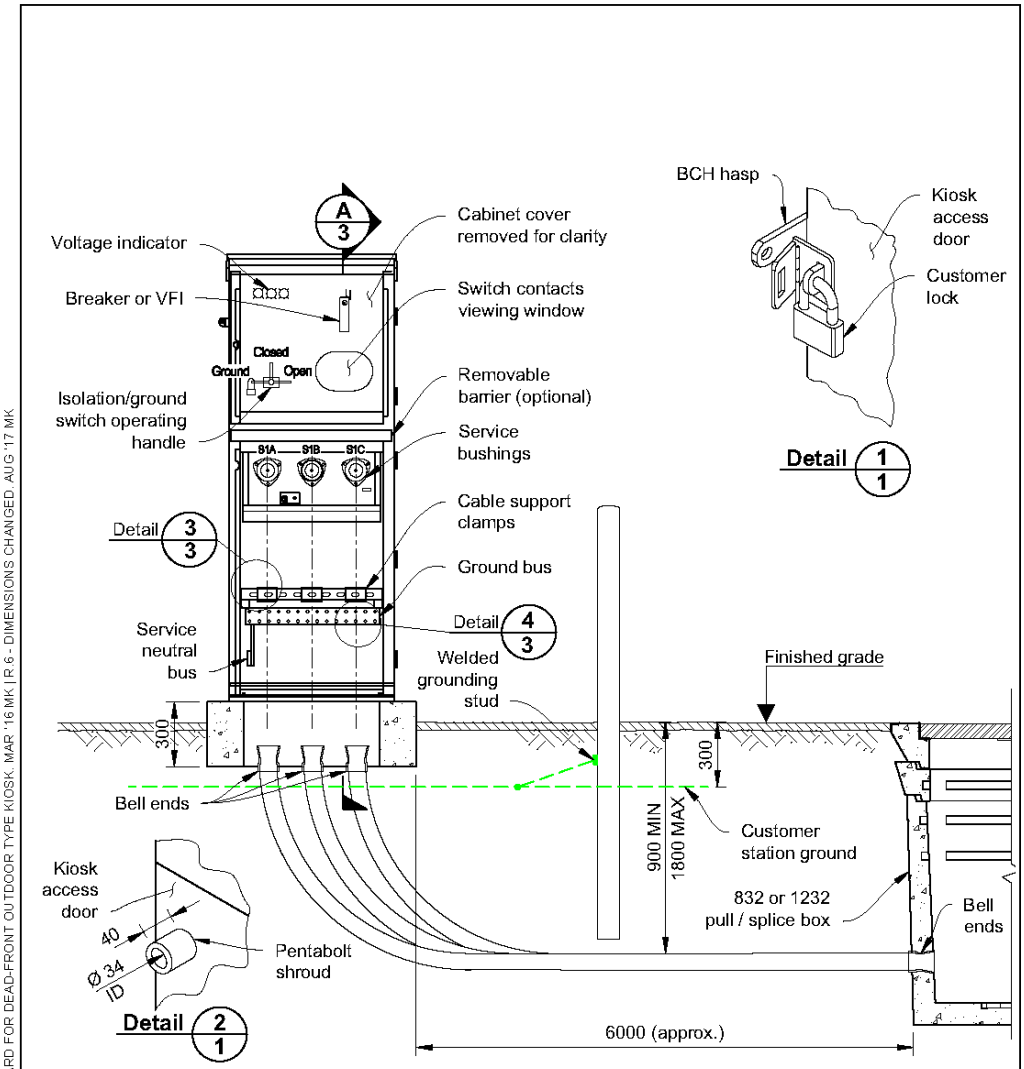
ES54 S3-01 Primary Services Dead-Front Outdoor Type Kiosk Private Property Installation



Site Layout

REVISIONS: R.5 - TITLE CHANGED. NEW STANDARD FOR DEAD-FRONT OUTDOOR TYPE KIOSK: MAR '16 MK | R.6 - DIMENSIONS CHANGED. AUG '17 MK

DESIGNED	RECOMMENDED	ACCEPTED	ENGINEER OF RECORD	PRIMARY SERVICES DEAD-FRONT OUTDOOR TYPE KIOSK PRIVATE PROPERTY INSTALLATION	
M. KELVIN	Original signed by A. NORRIS	F. DENNERT			
DISTRIBUTION STANDARDS BC Hydro	ISSUED: AUG 2017 REPLACES:MAR 2016 ORIGINALLY ISSUED: FEB 1981			PAGE 1 OF 6	ES54 S3-01.01 R 6



Dead Front Outdoor Kiosk
Front Elevation
(Typical)

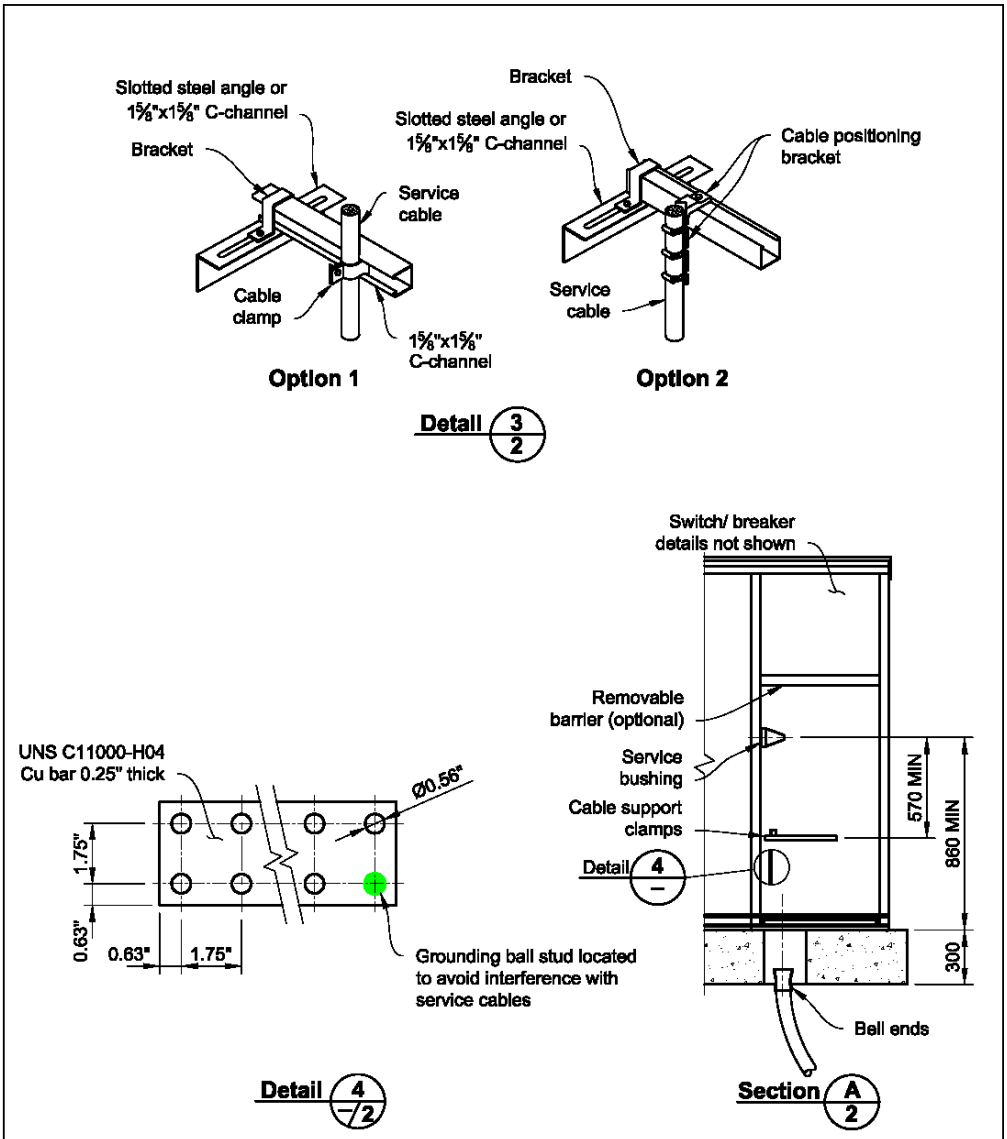
REVISIONS: R.5 - TITLE CHANGED. NEW STANDARD FOR DEAD-FRONT OUTDOOR TYPE KIOSK. MAR '16 MK | R.6 - DIMENSIONS CHANGED. AUG '17 MK

DESIGNED	RECOMMENDED	ACCEPTED	ENGINEER OF RECORD
Original signed by			
M. KELVIN	A. NORRIS	F. DENNERT	

DISTRIBUTION STANDARDS
BC Hydro
ISSUED: AUG 2017
REPLACES:MAR 2016
ORIGINALLY ISSUED: FEB 1981

PRIMARY SERVICES
DEAD-FRONT OUTDOOR TYPE KIOSK
PRIVATE PROPERTY INSTALLATION

PAGE 2 OF 6 | ES54 S3-01.02 | R 6



1 Materials

1.1 All materials shown shall be supplied by the customer except for cables, cable clamps and/or cable positioning brackets.

1.2 All materials from the BC Hydro duct stub-off to the point of delivery shall comply with the BC Electrical Code (and the amending bulletins issued by the BCSA) and the minimum requirements specified herein.

2 Installation Requirements

2.1 General

a. Installation shall be done by the customer, except for BC Hydro supplied materials.

b. Methods of installation shall comply with the BCEC (and the amending bulletins issued by the BCSA) and with the requirements specified in the ES54 construction standards.

c. The trench line and grade shall be straight and uniform, as near as possible to the BC Hydro duct stub-off from the service duct entrance into the customer outdoor kiosk. The trench installation detail shall be in accordance with ES54 H1-01.

d. The BC Hydro designer may specify additional installation requirements for construction on unstable ground, as detailed in ES54 U4-01.

2.2 Ducting

a. The customer duct on private property shall connect onto the BC Hydro duct at the stub-off, and any markers and/or duct caps shall be discarded.

b. The minimum radius for both 75 mm and 100 mm duct bends shall be 914 mm, and for 125 mm duct bends shall be 1050 mm.

c. Although BC Hydro makes every effort to prevent water from entering into its service ducts, a small amount may be passed to the customer duct. It is the customer's responsibility to provide adequate duct drainage, as permitted by the AHJ's Building Department.

d. Throughout its installation, the service duct shall be kept free from any obstructions, including sand and gravel. The duct shall be proved by mandrelling before the final connection is made to the BC Hydro duct and before a pull string is installed.

e. Due to the more constrained supply service cable compartment allowed for dead-front type equipment, it is critical that each service duct be aligned directly underneath each service bushing. The customer shall ensure that the ducts are constructed as such. Failure to do so may prevent installation of the service cables by BC Hydro, incurring delays and requiring reconfiguration of the service ducts by the customer.

f. A #8 diameter pull string shall be installed in the service duct. It shall be securely tied to the string in the BC Hydro duct stub-off and tied off in each pull box and at the service entrance

REVISIONS: R.5 - TITLE CHANGED. NEW STANDARD FOR DEAD-FRONT OUTDOOR TYPE KIOSK. MAR '16 MK | R.6 - DIMENSIONS CHANGED. AUG '17 MK

DESIGNED	RECOMMENDED	ACCEPTED	ENGINEER OF RECORD	PRIMARY SERVICES DEAD-FRONT OUTDOOR TYPE KIOSK PRIVATE PROPERTY INSTALLATION	
Original signed by					
M. KELVIN	A. NORRIS	F. DENNERT			
DISTRIBUTION STANDARDS BC Hydro	ISSUED: AUG 2017 REPLACES:MAR 2016 ORIGINALLY ISSUED: FEB 1981			PAGE 4 OF 6	ES54 S3-01.04 R 6

equipment. If no string is found in the stub-off, the customer shall notify the BC Hydro Designer for further instructions.

2.3 Concrete Encasement

a. Concrete encasement may be required by the BC Hydro Designer, and shall be done in accordance with ES54 H1-01.

b. At locations where the service duct passes through, or enters into, a vertical concrete wall, and where differential settlement may impose a shear force on the service duct, the customer shall ensure a smooth transition to avoid any damage to the ducts and conductors. The BC Hydro designer may request the customer to specify the estimated settlement of the structure and required service cable slack, and the customer shall submit the engineered design of the concrete-encased rebar-reinforced wall entry to BC Hydro for acceptance.

2.4 Service Cable Support

a. The cable support channel shall be configurable by the installer in either of the two options shown in Detail 3, and shall be reconfigurable to either of the options during future cable replacement and/or other work. The assembly shall be adjustable inward/outward a minimum of +15 mm, -75 mm when the front edge of the channel is aligned with the plane of the connection surface of the service bushings.

2.5 Grounding

a. Grounding studs shall be supplied as indicated and installed as per the manufacturer's instructions. Only the following grounding studs are acceptable to BC Hydro:

AB Chance	C600-2102
Hastings	21721
Salisbury	21191

3 Consulting Agreement

3.1 Agreement must be obtained from the BC Hydro District/Area Manager for the following:

a. Any variance due to local conditions, and/or

b. The suitability of the service conduit and pull string for cable pulling.

3.2 Approval must be obtained from the local Electricity Safety Officer for the following:

a. All materials and methods of installation on private property, and Final Inspection of the installation.

4 832/1232 Pull Box

4.1 For 4/0 AWG service supply cables, the customer shall supply and install an 832 Box with one riser, equipped with BC Hydro standard aluminum lids and proprietary puzzlebolts, for BC Hydro restricted access only.

REVISIONS: R.5 - TITLE CHANGED. NEW STANDARD FOR DEAD-FRONT OUTDOOR TYPE KIOSK. MAR '16 MK | R.6 - DIMENSIONS CHANGED. AUG '17 MK

DESIGNED	RECOMMENDED	ACCEPTED	ENGINEER OF RECORD	PRIMARY SERVICES DEAD-FRONT OUTDOOR TYPE KIOSK PRIVATE PROPERTY INSTALLATION	
Original signed by					
M. KELVIN	A. NORRIS	F. DENNERT			
DISTRIBUTION STANDARDS BC Hydro	ISSUED: AUG 2017 REPLACES:MAR 2016 ORIGINALLY ISSUED: FEB 1981			PAGE 5 OF 6	ES54 S3-01.05 R 6

4.2 For 500 kcm service supply cables, the customer shall supply and install a 1232 Box with two risers, equipped with BC Hydro standard aluminum lids and proprietary puzzlebolts, for BC Hydro restricted access only.

4.3 For 750 kcm service supply cables, the customer shall supply and install a 1232 Box with two risers, equipped with BC Hydro standard aluminum lids and proprietary puzzlebolts, for BC Hydro restricted access only.

4.4 If the customer wishes not to install a local 832/1232 pull box for close proximity to the BC Hydro supply, the BC Hydro Designer shall obtain acceptance from a local BC Hydro Field Manager.

Reference Document

BC Hydro Requirements for Customers Primary Services Supplied at 4 kV and 35 kV – "Primary Guide".

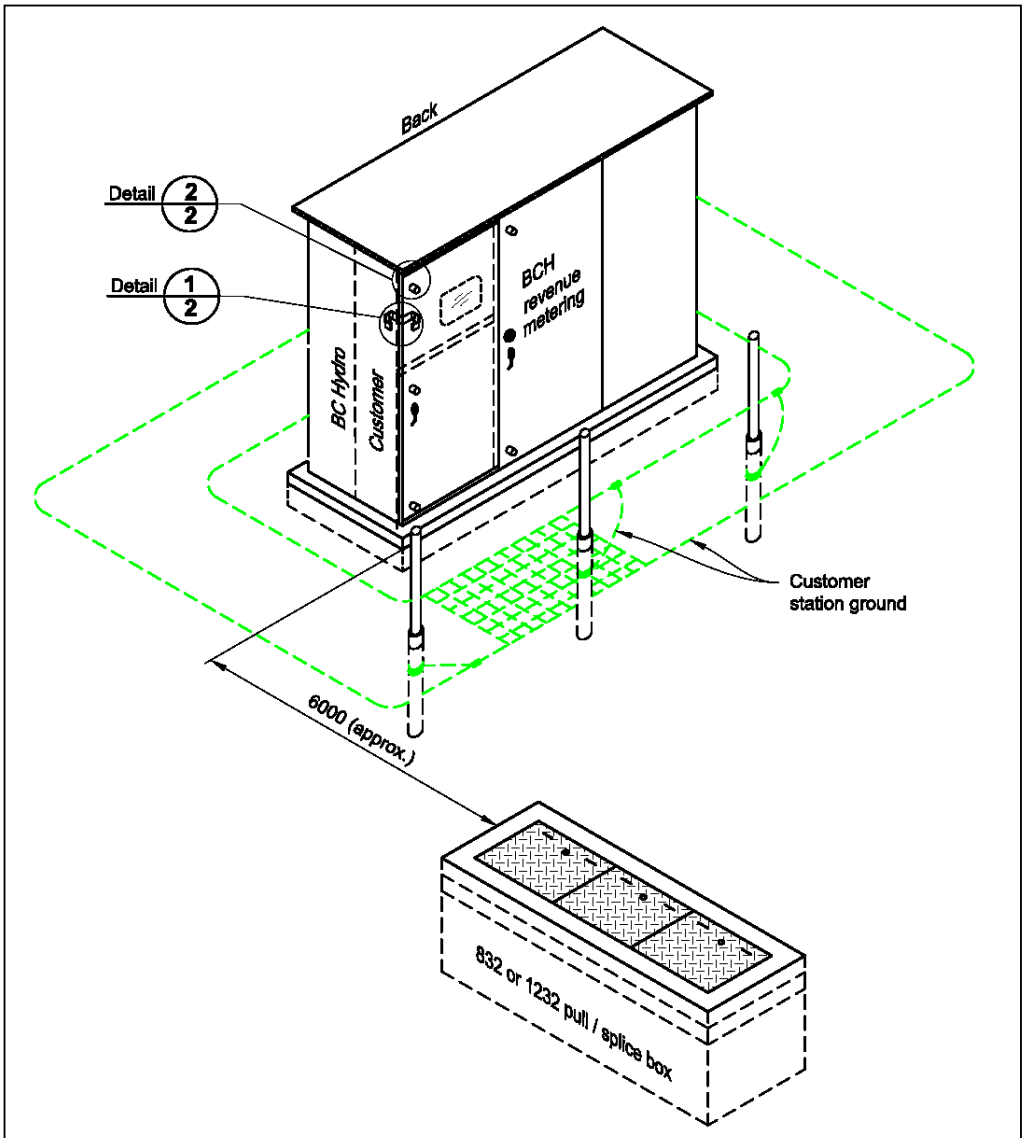
Reference Standards

ES54 H1-01	General Trenching Details, URD and UD Installations
ES53 S3-01	Primary Services, Customer-Owned Service Equipment - Electrical Installation Details
ES54 Section W	Construction Specifications

REVISIONS: R.5 - TITLE CHANGED. NEW STANDARD FOR DEAD-FRONT OUTDOOR TYPE KIOSK. MAR '16 MK | R.6 - DIMENSIONS CHANGED. AUG '17 MK

DESIGNED	RECOMMENDED	ACCEPTED	ENGINEER OF RECORD	PRIMARY SERVICES DEAD-FRONT OUTDOOR TYPE KIOSK PRIVATE PROPERTY INSTALLATION	
Original signed by					
M. KELVIN	A. NORRIS	F. DENNERT			
DISTRIBUTION STANDARDS BC Hydro	ISSUED: AUG 2017 REPLACES:MAR 2016 ORIGINALLY ISSUED: FEB 1981			PAGE 6 OF 6	ES54 S3-01.06 R 6

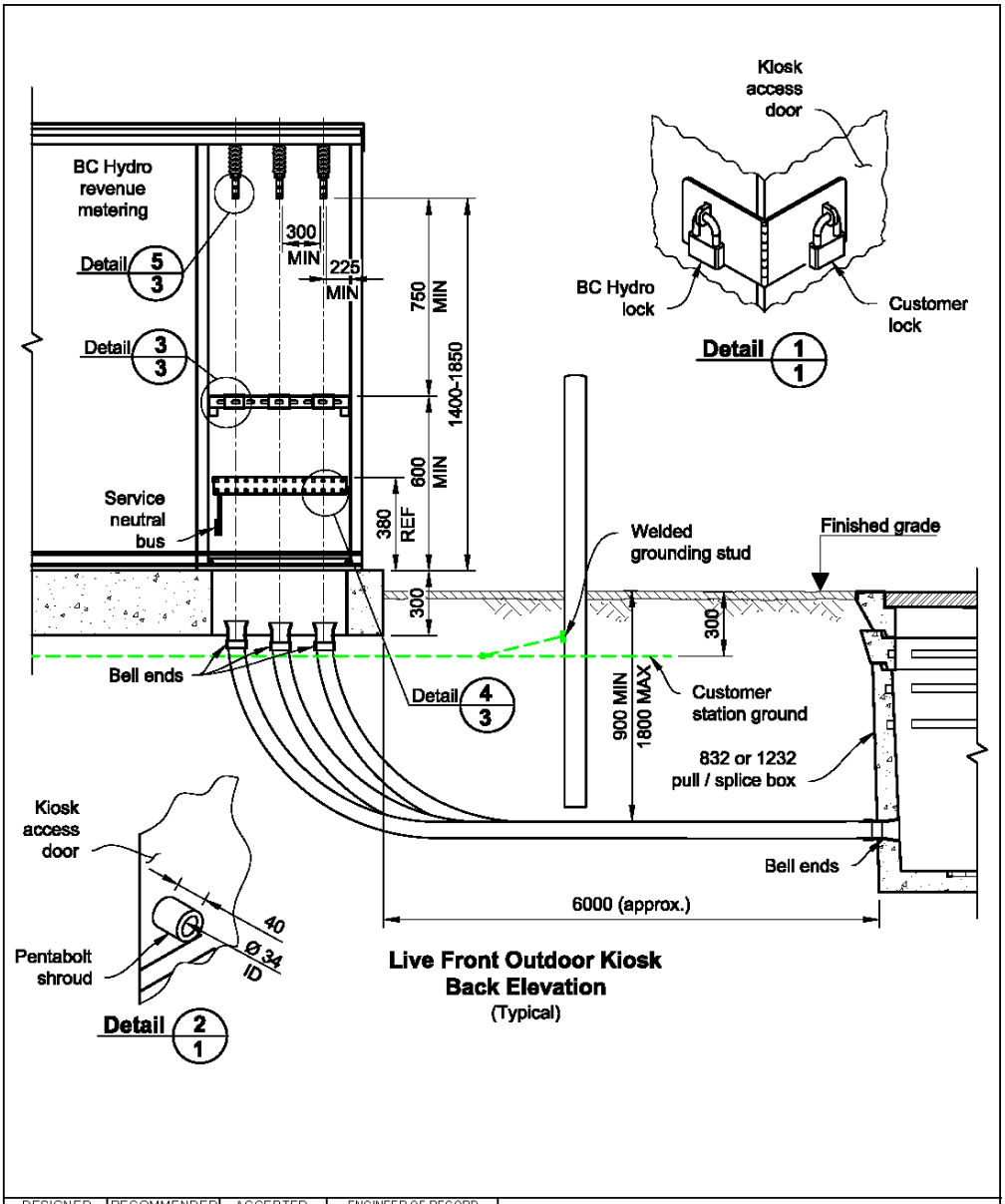
ES54 S3-02 Primary Services Live-Front Outdoor Type Kiosk Private Property Installation



Site Layout

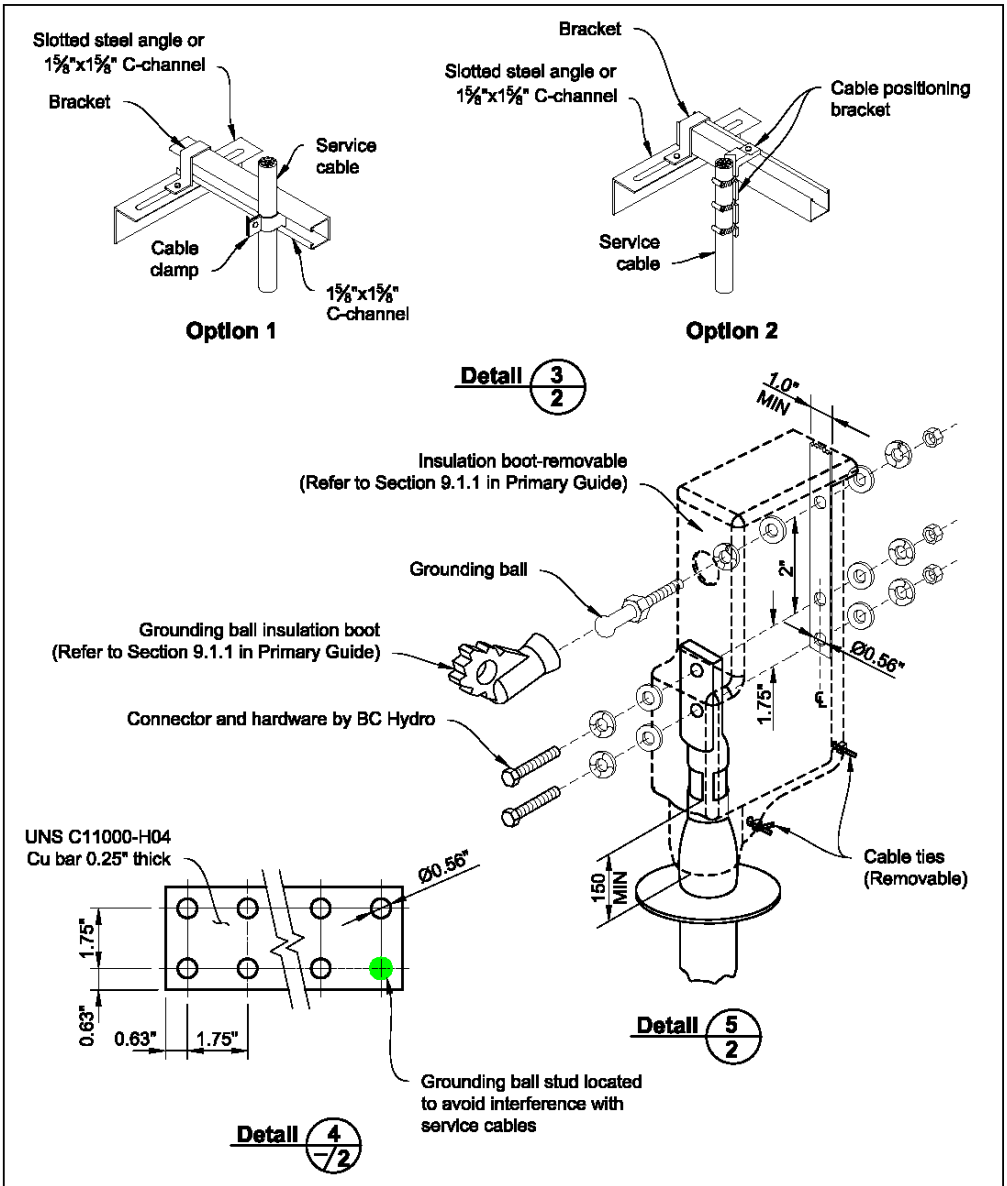
REVISIONS: R.1 - DIMENSIONS CHANGED AND INSULATION BOOT ADDED. AUG '17 MK

DESIGNED	RECOMMENDED	ACCEPTED	ENGINEER OF RECORD	PRIMARY SERVICES LIVE-FRONT OUTDOOR TYPE KIOSK PRIVATE PROPERTY INSTALLATION	
Original signed by					
M. KELVIN	A. NORRIS	F. DENNERT			
DISTRIBUTION STANDARDS BC Hydro	ISSUED: AUG 2017 REPLACES:MAR 2016 ORIGINALLY ISSUED: MAR 2016			PAGE 1 OF 6	ES54 S3-02.01 R 1



REVISIONS: R 1 - DIMENSIONS CHANGED AND INSULATION BOOT ADDED. AUG '17 MK

DESIGNED	RECOMMENDED	ACCEPTED	ENGINEER OF RECORD	PRIMARY SERVICES LIVE-FRONT OUTDOOR TYPE KIOSK PRIVATE PROPERTY INSTALLATION	
Original signed by					
M. KELVIN	A. NORRIS	F. DENNERT			
DISTRIBUTION STANDARDS BC Hydro	ISSUED: AUG 2017 REPLACES:MAR 2016 ORIGINALLY ISSUED: MAR 2016			PAGE 2 OF 6	ES54 S3-02.02 R 1



REVISIONS: R 1 - DIMENSIONS CHANGED AND INSULATION BOOT ADDED. AUG-17 MK

DESIGNED	RECOMMENDED	ACCEPTED	ENGINEER OF RECORD
Original signed by			
M. KELVIN	A. NORRIS	F. DENNERT	

DISTRIBUTION STANDARDS
BC Hydro
ISSUED: AUG 2017
REPLACES:MAR 2016
ORIGINALLY ISSUED: MAR 2016

PRIMARY SERVICES
LIVE-FRONT OUTDOOR TYPE KIOSK
PRIVATE PROPERTY INSTALLATION

PAGE 3 OF 6 | ES54 S3-02.03 | R 1

1 Materials

1.1 All materials shown shall be supplied by the customer except for cables, cable clamps and/or cable positioning brackets.

1.2 All materials from the BC Hydro duct stub-off to the point of delivery shall comply with the BCEC (and the amending bulletins issued by the BCSA) and the minimum requirements specified herein.

2 Installation Requirements

2.1 General

a. Installation shall be done by the customer, except for BC Hydro supplied materials.

b. Methods of installation shall comply with the BCEC (and the amending bulletins issued by the BCSA) and with the requirements specified in the ES54 construction standards.

c. The trench line and grade shall be straight and uniform, as near as possible to the BC Hydro duct stub-off from the service conduit entrance into the customer outdoor kiosk. The trench installation detail shall be in accordance with ES54 H1-01.

d. The BC Hydro Designer may specify additional installation requirements for construction on unstable ground, as detailed in ES54 U4-01.

e. The minimum clearance between adjacent HV bus bars shall be 300 mm. The minimum clearance between an HV bus and any adjacent grounded surface, including the compartment door when open or closed, shall be 225 mm. The grounding stud shall be considered part of the HV bus that it is attached to for the purposes of establishing minimum clearances.

2.2 Ducting

a. The customer duct on private property shall connect onto the BC Hydro duct at the stub-off, and any markers and/or duct caps shall be discarded.

b. The minimum radius for both 75 mm and 100 mm duct bends shall be 914 mm, and it shall be 1050 mm for 125 mm duct bends.

c. Although BC Hydro makes every effort to prevent water from entering into its service ducts, a small amount may be passed to the customer duct. It is the customer's responsibility to provide adequate duct drainage, as permitted by the AHJ's Building Department.

d. Throughout its installation, the service duct shall be kept free of any obstructions, including sand and gravel. The conduit shall be proved by mandrelling before the final connection is made to the BC Hydro duct and before a pull string is installed.

e. Each service duct shall be aligned directly underneath each service bushing.

f. A #8 diameter pull string shall be installed in the service duct. It shall be securely tied to the string in the BC Hydro duct stub-off and tied off in each pull box and at the service entrance

REVISIONS: R.1 - DIMENSIONS CHANGED AND INSULATION BOOT ADDED. AUG.'17 MK

DESIGNED	RECOMMENDED	ACCEPTED	ENGINEER OF RECORD	PRIMARY SERVICES LIVE-FRONT OUTDOOR TYPE KIOSK PRIVATE PROPERTY INSTALLATION	
Original signed by					
M. KELVIN	A. NORRIS	F. DENNERT			
DISTRIBUTION STANDARDS BC Hydro	ISSUED: AUG 2017 REPLACES:MAR 2016 ORIGINALLY ISSUED: MAR 2016			PAGE 4 OF 6	ES54 S3-02.04 R 1

equipment. If no string is found in the stub-off, the customer shall notify the BC Hydro designer for further instructions.

2.3 Concrete Encasement

a. Concrete encasement may be required by the BC Hydro designer, and shall be done in accordance with ES54 H1-01.

b. At locations where the service duct passes through, or enters into, a vertical concrete wall, and where differential settlement may impose a shear force on the service duct, the customer shall ensure a smooth transition to avoid any damage to the ducts and conductors. The BC Hydro designer may request the customer to specify the estimated settlement of the structure and required service cable slack, and the customer shall submit the engineered design of the concrete encased rebar reinforced wall entry to BC Hydro for acceptance.

2.4 Service Cable Support

a. The cable support channel shall be configurable by the installer in either of the two options shown in Detail 3, and shall be reconfigurable to either of the options during future cable replacement and/or other work. The assembly shall be adjustable inward/outward a minimum of +15 mm, -75 mm when the front edge of the channel is aligned with the plane of the connection surface of the service bus bars.

2.5 Grounding

a. Grounding studs shall be supplied as indicated and installed as per the manufacturer's instructions. Only the following grounding studs are acceptable to BC Hydro:

AB Chance	C600-2102
Hastings	21721
Salisbury	21191

b. It shall be possible to close and secure the compartment door with ground set(s) installed on the HV bus.

3 Consulting Agreement

3.1 Agreement must be obtained from the BC Hydro District/Area Manager for the following:

a. Any variance due to local conditions, and/or

b. The suitability of the service duct and pull string for cable pulling.

3.2 Approval must be obtained from the local Electricity Safety Officer for the following:

a. All material and methods of installation on private property and Final Inspection of the installation.

REVISIONS: R 1 - DIMENSIONS CHANGED AND INSULATION BOOT ADDED. AUG '17 MK

DESIGNED	RECOMMENDED	ACCEPTED	ENGINEER OF RECORD	PRIMARY SERVICES LIVE-FRONT OUTDOOR TYPE KIOSK PRIVATE PROPERTY INSTALLATION	
Original signed by					
M. KELVIN	A. NORRIS	F. DENNERT			
DISTRIBUTION STANDARDS BC Hydro	ISSUED: AUG 2017 REPLACES:MAR 2016 ORIGINALLY ISSUED: MAR 2016			PAGE 5 OF 6	ES54 S3-02.05 R 1

4 832/1232 Pull Box

4.1 For 4/0 AWG service supply cables, the customer shall supply and install an 832 Box with one riser, equipped with BC Hydro standard aluminum lids and proprietary puzzlebolts, for BC Hydro restricted access only.

4.2 For 500 kcm service supply cables, the customer shall supply and install a 1232 Box with two risers, equipped with BC Hydro standard aluminum lids and proprietary puzzlebolts, for BC Hydro restricted access only.

4.3 For 750 kcm service supply cables, the customer shall supply and install a 1232 Box with two risers, equipped with BC Hydro standard aluminum lids and proprietary puzzlebolts, for BC Hydro restricted access only.

4.4 If the customer wishes not to install a local 832/1232 pull box for close proximity to the BC Hydro supply, the BC Hydro Designer shall obtain acceptance from a local BC Hydro Field Manager.

Reference Document

BC Hydro Requirements for Customers Primary Services Supplied at 4 kV to 35 kV – "Primary Guide".

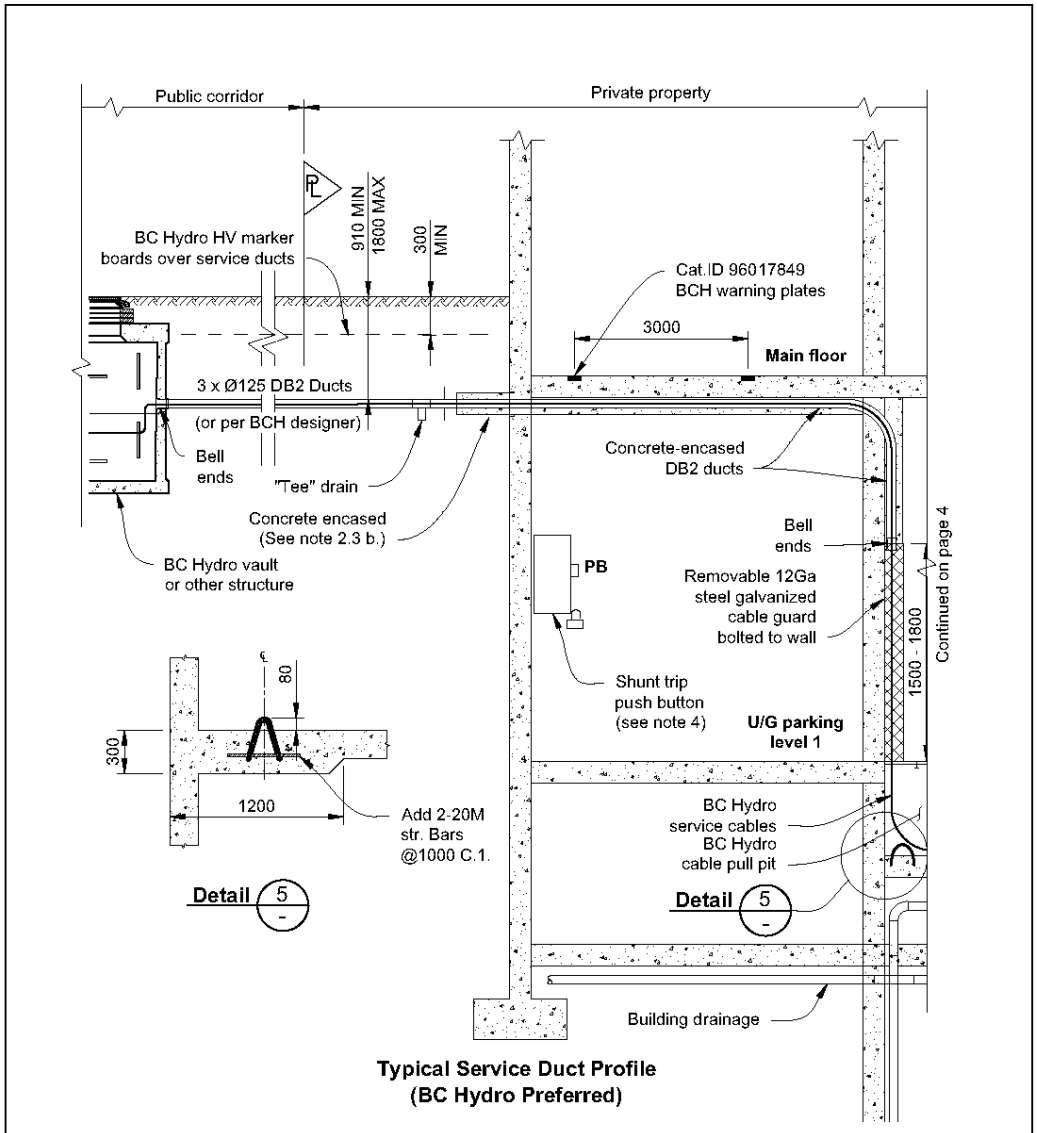
Reference Standards

ES54 H1-01	Duct General Trenching Details
ES53 S3-01	Primary Services - Electrical Installation Details
ES54 Section W	Construction Specifications

REVISIONS: R.1 - DIMENSIONS CHANGED AND INSULATION BOOT ADDED. AUG 17 MK

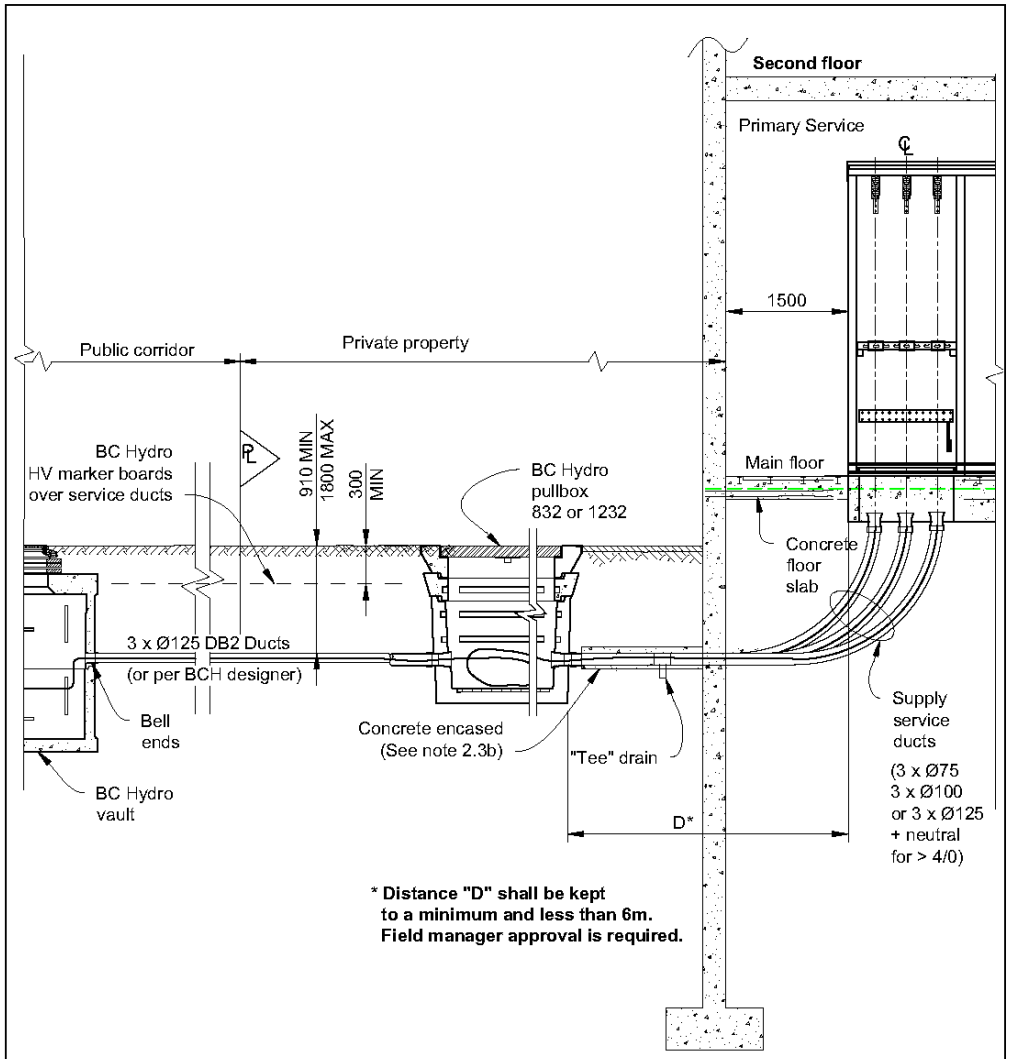
DESIGNED	RECOMMENDED	ACCEPTED	ENGINEER OF RECORD	PRIMARY SERVICES LIVE-FRONT OUTDOOR TYPE KIOSK PRIVATE PROPERTY INSTALLATION	
Original signed by					
M. KELVIN	A. NORRIS	F. DENNERT			
DISTRIBUTION STANDARDS BC Hydro	ISSUED: AUG 2017 REPLACES:MAR 2016 ORIGINALLY ISSUED: MAR 2016			PAGE 6 OF 6	ES54 S3-02.06 R 1

ES54 S3-03 Primary Services Live-Front Indoor Type Switchgear Private Property Installation



REVISIONS: R.1 - HIGH FLOOD LEVEL SERVICE ADDED AND DIMENSIONS CHANGED. AUG '17 MK

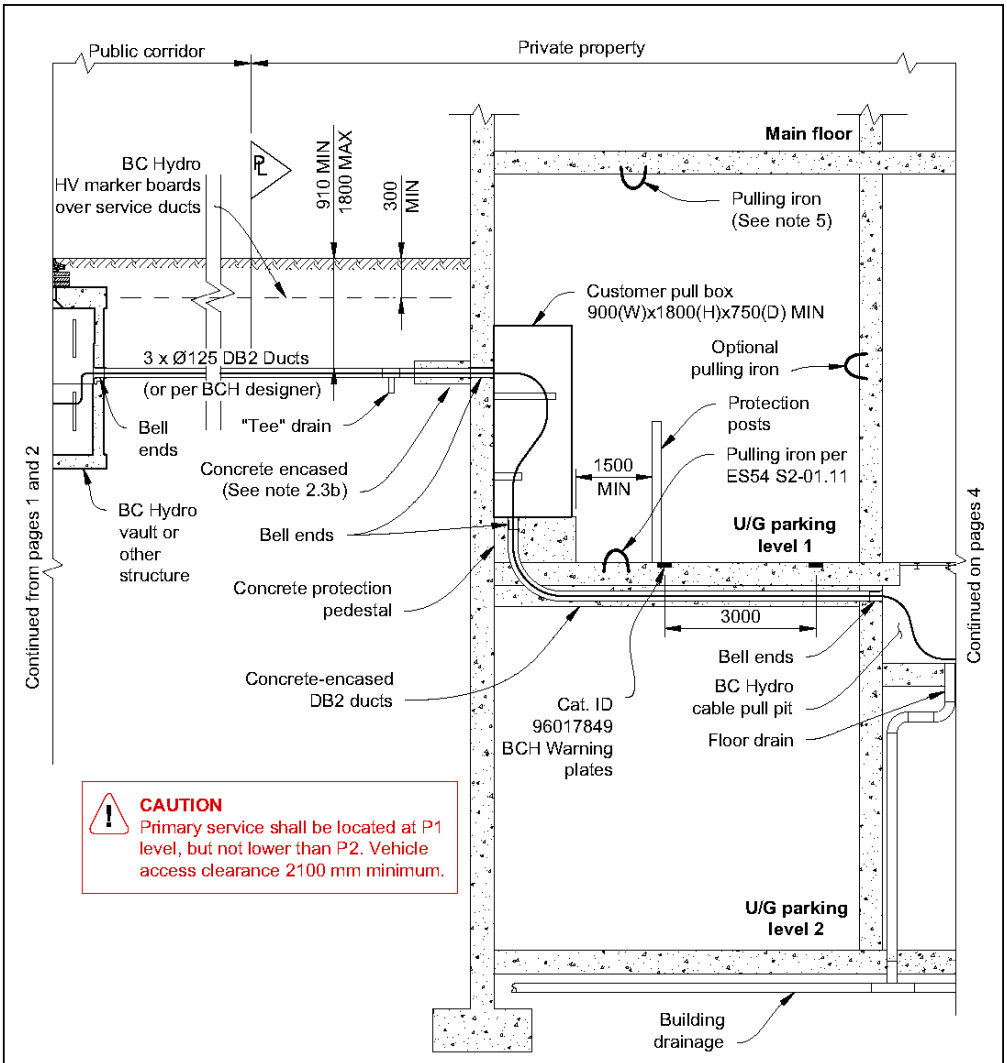
DESIGNED	RECOMMENDED	ACCEPTED	ENGINEER OF RECORD	PRIMARY SERVICES LIVE-FRONT INDOOR TYPE SWITCHGEAR PRIVATE PROPERTY INSTALLATION	
Original signed by					
M. KELVIN	A. NORRIS	F. DENNERT			
DISTRIBUTION STANDARDS BC Hydro	ISSUED: AUG 2017 REPLACES:MAR 2016 ORIGINALLY ISSUED: MAR 2016			PAGE 1 OF 9	ES54 S3-03.01 R 1



**HV Service Duct Installation
for High Flood Level Buildings**

REVISIONS: R 1 - HIGH FLOOD LEVEL SERVICE ADDED AND DIMENSIONS CHANGED AUG '17 MK

DESIGNED	RECOMMENDED	ACCEPTED	ENGINEER OF RECORD	PRIMARY SERVICES LIVE-FRONT INDOOR TYPE SWITCHGEAR PRIVATE PROPERTY INSTALLATION	
Original signed by					
M. KELVIN	A. NORRIS	F. DENNERT			
DISTRIBUTION STANDARDS BC Hydro	ISSUED: AUG 2017 REPLACES:MAR 2016 ORIGINALLY ISSUED: MAR 2016			PAGE 2 OF 9	ES54 S3-03.02 R 1



Typical Service Duct Profile
(Not Preferred- BC Hydro Approval Required)

REVISIONS: R 1 - HIGH FLOOD LEVEL SERVICE ADDED AND DIMENSIONS CHANGED AUG '17 MK

DESIGNED	RECOMMENDED	ACCEPTED	ENGINEER OF RECORD
Original signed by			
M. KELVIN	A. NORRIS	F. DENNERT	

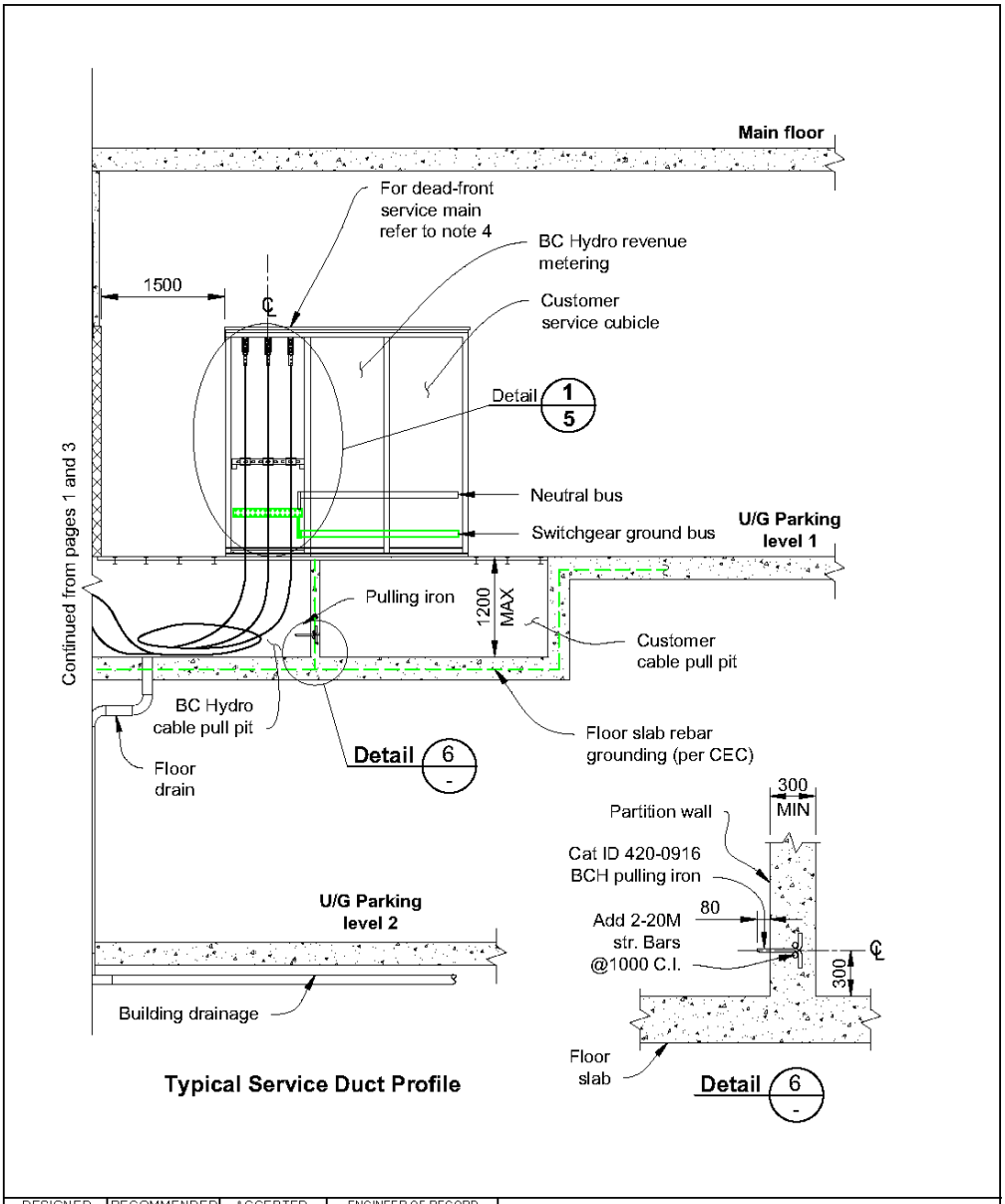
DISTRIBUTION STANDARDS BC Hydro
ISSUED: AUG 2017
REPLACES:MAR 2016
ORIGINALLY
ISSUED: MAR 2016

PRIMARY SERVICES
LIVE-FRONT INDOOR TYPE SWITCHGEAR
PRIVATE PROPERTY INSTALLATION

PAGE 3
OF 9

ES54 S3-03.03

R 1



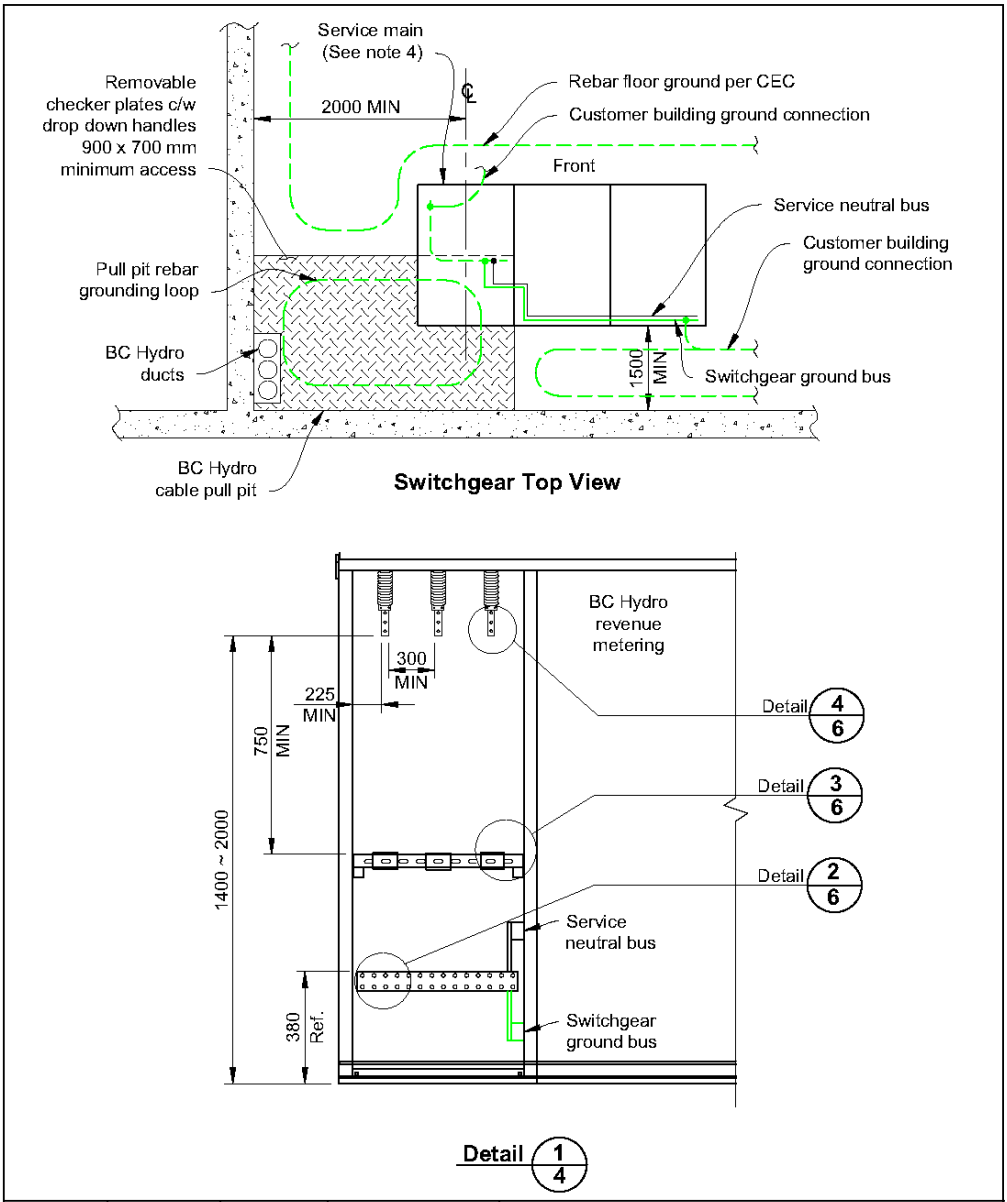
REVISIONS: R 1 - HIGH FLOOD LEVEL SERVICE ADDED AND DIMENSIONS CHANGED. AUG '17 MK

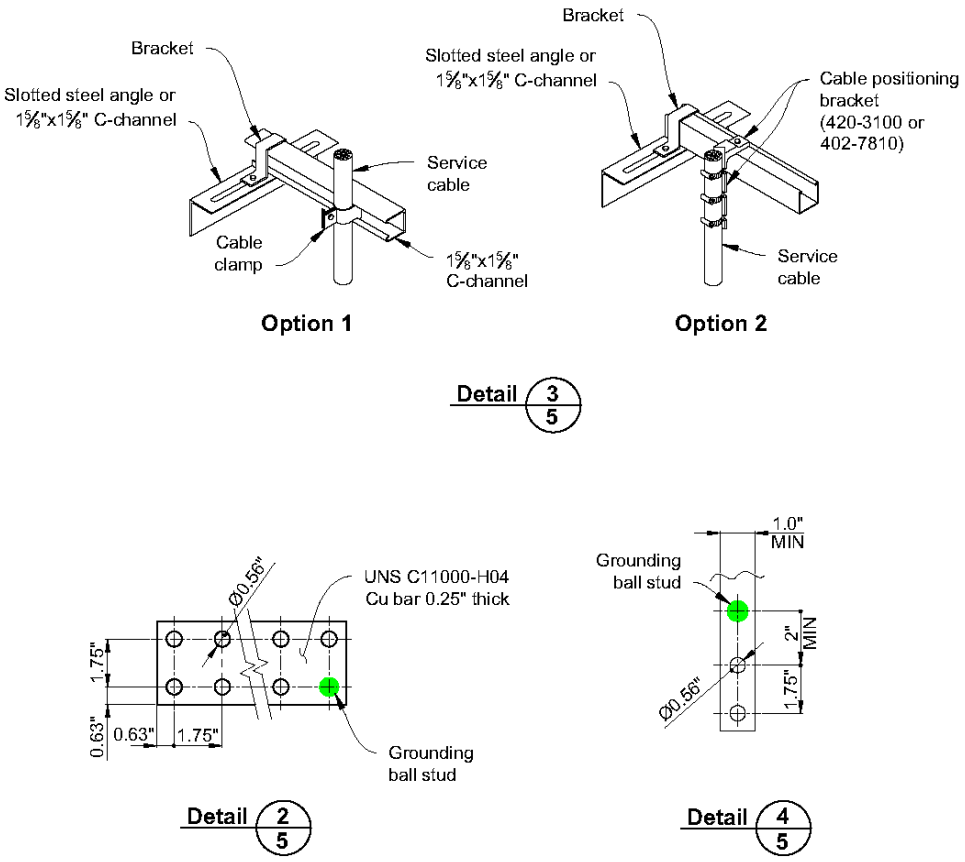
DESIGNED	RECOMMENDED	ACCEPTED	ENGINEER OF RECORD
	Original signed by		
M. KELVIN	A. NORRIS	F. DENNERT	

DISTRIBUTION STANDARDS BC Hydro
ISSUED: AUG 2017
REPLACES:MAR 2016
ORIGINALLY ISSUED: MAR 2016

PRIMARY SERVICES
LIVE-FRONT INDOOR TYPE SWITCHGEAR
PRIVATE PROPERTY INSTALLATION

PAGE 4 OF 9 | ES54 S3-03.04 | R 1





REVISIONS: R.1 - HIGH FLOOD LEVEL SERVICE ADDED AND DIMENSIONS CHANGED. AUG '17 MK

DESIGNED	RECOMMENDED	ACCEPTED	ENGINEER OF RECORD	PRIMARY SERVICES LIVE-FRONT INDOOR TYPE SWITCHGEAR PRIVATE PROPERTY INSTALLATION	
Original signed by					
M. KELVIN	A. NORRIS	F. DENNERT			
DISTRIBUTION STANDARDS BC Hydro	ISSUED: AUG 2017 REPLACES:MAR 2016 ORIGINALLY ISSUED: MAR 2016			PAGE 6 OF 9	ES54 S3-03.06 R 1

1 Materials

1.1 All materials shown shall be supplied by the customer except BC Hydro service cables, cable clamps and/or cable positioning brackets.

1.2 All materials from the BC Hydro duct stub-off to the point of connection shall comply with the BCEC (and the amending bulletins issued by the BCSA) and the minimum requirements specified herein.

1.3 The BC Hydro Designer may specify rigid steel ducts inside buildings for bends that are not concrete-encased, and that are subject to excessive sidewall abrasion due to cable pulling.

1.4 When service cables are installed with each phase in a separate duct, the design shall prevent eddy current heating in ferrous components (including ducts, attachments, routing, etc.).

1.5 The customer cable pull pit checker plate covers shall be aluminum, 6 mm thick, with integral drop-down lifting handles. The maximum weight of the removable panels is 40 lbs (19 kg), and of the hinged panels is 80 lbs (38 kg).

1.6 The customer shall set BC Hydro cast iron marker plates, Cat. ID 96017849, in the walls, floors and/or ceilings to indicate HV concrete-encased cables, per BCEC Rule 36-100 (4).

2 Installation Requirements

2.1 General

a. All civil installation shall be done by the customer, including BC Hydro supplied civil materials.

b. Methods of installation shall comply with the BCEC (and the amending bulletins issued by the BCSA) and with the requirements specified herein.

c. The trench line and grade shall be straight and uniform, as near as possible to the BC Hydro duct stub-off from the service conduit entrance into the building. The trench installation detail shall be in accordance with ES54 H1-01.

d. The service duct entrance into the building, and the trench, shall be coordinated with other utilities to avoid crossovers and dig-ins.

e. The BC Hydro designer may specify additional installation requirements for construction on unstable ground, as detailed in ES54 U4-01.

f. For customer building services located in high flood level areas, the customer, in agreement with the BC Hydro designer, may eliminate the cable pull pit located below the primary service utility compartment to avoid water accumulation inside the building. For this type of service connection, the customer would install a mid-run pull box (832 or 1232 box) outside the building, as shown on page 2.

g. The cable support channel shall be configurable by the installer in either of the two options shown in Detail 3, and shall be reconfigurable to either of the options during future cable replacement and/or other work. The assembly shall be adjustable inward/outward a minimum of +15 mm, -75 mm when the front edge of the channel is aligned with the plane of the connection surface of the service bus bars or bushings.

h. The minimum clearance between adjacent HV bus bars shall be 300 mm. The minimum clearance between an HV bus and any adjacent grounded surface, including the compartment door when open or closed, shall be 225 mm. The grounding stud shall be considered part of the HV bus that it is attached to for the purposes of establishing minimum clearances.

REVISIONS: R.1 - HIGH FLOOD LEVEL SERVICE ADDED AND DIMENSIONS CHANGED AUG '17 MK

DESIGNED	RECOMMENDED	ACCEPTED	ENGINEER OF RECORD	PRIMARY SERVICES LIVE-FRONT INDOOR TYPE SWITCHGEAR PRIVATE PROPERTY INSTALLATION	
Original signed by					
M. KELVIN	A. NORRIS	F. DENNERT			
DISTRIBUTION STANDARDS BC Hydro	ISSUED: AUG 2017 REPLACES:MAR 2016 ORIGINALLY ISSUED: MAR 2016			PAGE 7 OF 9	ES54 S3-03.07 R 1

2.2 Ducting and Cable Pull Pit

a. The customer duct shall connect onto the BC Hydro duct at the stub-off and any markers and/or duct caps shall be discarded.

b. The minimum radius for both 75 mm and 100 mm duct bends shall be 914 mm, and shall be 1050 mm for 125 mm duct bends.

c. Although BC Hydro makes every effort to prevent water from entering into its service ducts, a small amount may be passed to the customer duct, BC Hydro service cables and shields. It is the customer's responsibility to provide adequate duct drainage, as permitted by the AHJ's Building Department.

d. Throughout its installation, the service duct shall be kept free of any obstructions, including sand and gravel. The conduit shall be proved by mandrelling before the final connection is made to the BC Hydro duct and before a pull string is installed.

e. A #8 diameter pull string shall be installed in the service duct. It shall be securely tied to the string in the BC Hydro duct stub-off and tied off in each pull box and at the service entrance equipment. If no string is found in the stub-off, the customer shall notify the BC Hydro Designer for further instructions.

f. The customer shall install BC Hydro cable pulling irons, Cat ID 96017849, as indicated, reinforced with 2-20M rebar, 1000 mm long, inside a minimum 300 mm-thick concrete wall.

g. The customer shall consult the BC Hydro Designer for acceptance of mid-run pull boxes, subject to approval by the local Field Manager. Pulling irons at mid-run pull boxes shall comply with ES54 S2-01.11.

2.3 Concrete Encasement

a. Concrete encasement of service ducts may be required by the BC Hydro Designer, and shall be done in accordance with ES54 H1-01.

b. At locations where the service duct passes through, or enters into, a vertical concrete foundation wall, and where differential settlement may impose a shear force on the service duct, the customer shall ensure a smooth transition to avoid any damage to the ducts and conductors. The BC Hydro Designer may request the customer to specify the estimated settlement of the building structure and required service cable slack, and the customer shall submit the engineered design of the concrete-encased rebar-reinforced wall entry for the service ducts to BC Hydro for acceptance.

2.4 Grounding

a. Grounding studs shall be supplied as indicated and installed as per the manufacturer's instructions. Only the following grounding studs are acceptable to BC Hydro:

AB Chance	C600-2102
Hastings	21721
Salisbury	21191

b. The minimum clearance between adjacent HV bus bars shall be 300 mm. The minimum clearance between an HV bus and any adjacent grounded surface, including the compartment door when open or closed, shall be 225 mm. The grounding stud shall be considered part of the HV bus that it is attached to for the purposes of establishing minimum clearances.

REVISIONS: R 1 - HIGH FLOOD LEVEL SERVICE ADDED AND DIMENSIONS CHANGED. AUG '17 MK

DESIGNED	RECOMMENDED	ACCEPTED	ENGINEER OF RECORD	PRIMARY SERVICES LIVE-FRONT INDOOR TYPE SWITCHGEAR PRIVATE PROPERTY INSTALLATION	
Original signed by					
M. KELVIN	A. NORRIS	F. DENNERT			
DISTRIBUTION STANDARDS BC Hydro	ISSUED: AUG 2017 REPLACES:MAR 2016 ORIGINALLY ISSUED: MAR 2016			PAGE 8 OF 9	ES54 S3-03.08 R 1

3 Consulting Agreement

3.1 Agreement must be obtained from the BC Hydro District/Area Manager for the following:

a. Any variance due to local conditions, and/or

b. The suitability of the service duct and pull string for cable pulling.

3.2 Approval must be obtained from the local Electricity Safety Officer for the following:

a. All material and methods of installation on private property and Final Inspection of the installation.

4 Dead Front Indoor Primary Services

Indoor-type primary service equipment shall comply with BCEC and BCBC rules for the installation of oil-filled and gas-filled equipment inside the building. In addition, this type of service shall have a remote shunt-trip pushbutton, hard-wired to the service main trip coil, ready to shut off the service. The pushbutton shall be located outside the primary service room, at a readily accessible location, and shall be equipped with a hasp for the installation of a BC Hydro padlock.

Specific requirements for dead front indoor equipment shall be based on the applicable requirements provided for the outdoor type (ES54 S3-01). Proposals for dead front indoor primary services are encouraged for improved safety and reliability. Designs will be reviewed by BC Hydro and may be allowed to proceed with "beta site" installation if they meet BC Hydro operational, safety and construction requirements. Requirements for any beta site installation(s) and related conditions of acceptance will be communicated to the customer at the time the beta site is allowed. Following successful beta site installation(s) and resolution of any conditions of acceptance, BC Hydro may authorize the equipment for unrestricted application.

Reference Document

BC Hydro Requirements for Customers Primary Services Supplied at 4 kV to 35 kV – "Primary Guide"

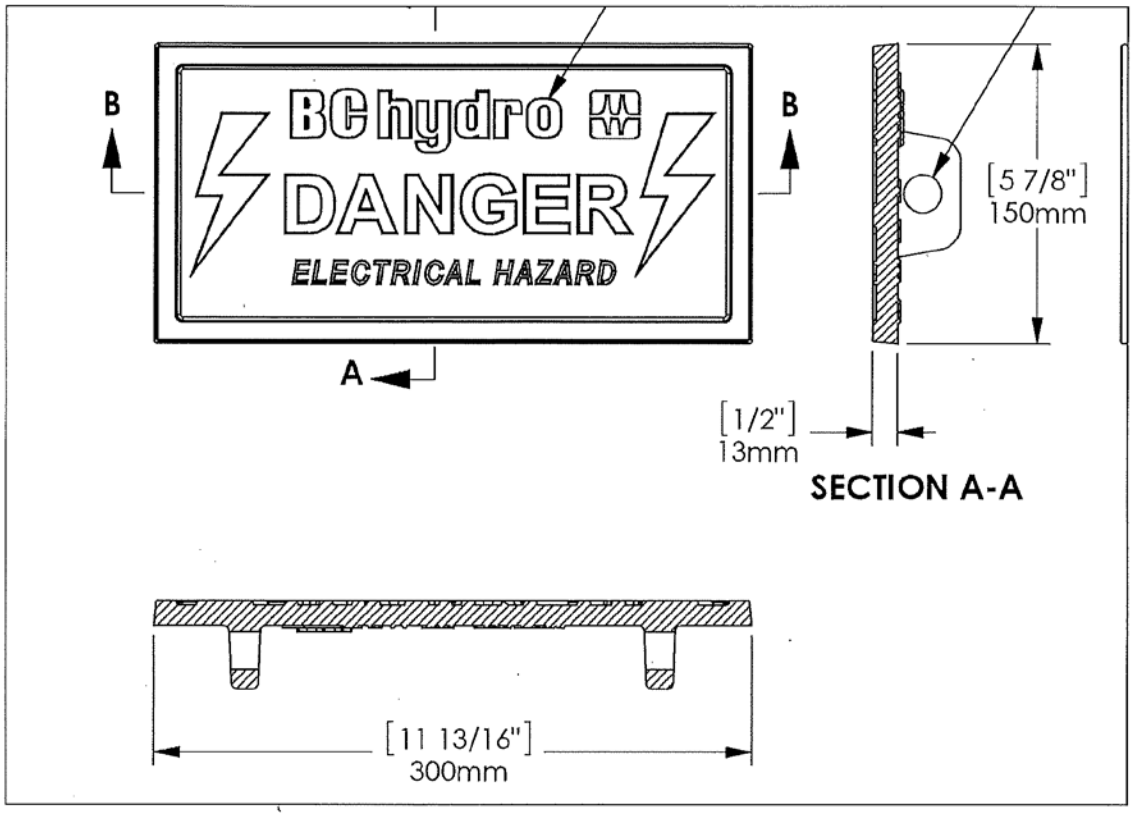
Reference Standards

ES54 H1-01	General Trenching Details, URD and UD Installations
ES53 S3-01	Primary Services, Customer-Owned Service Equipment, Electrical Installation Details
ES54 Section W	Construction Specifications

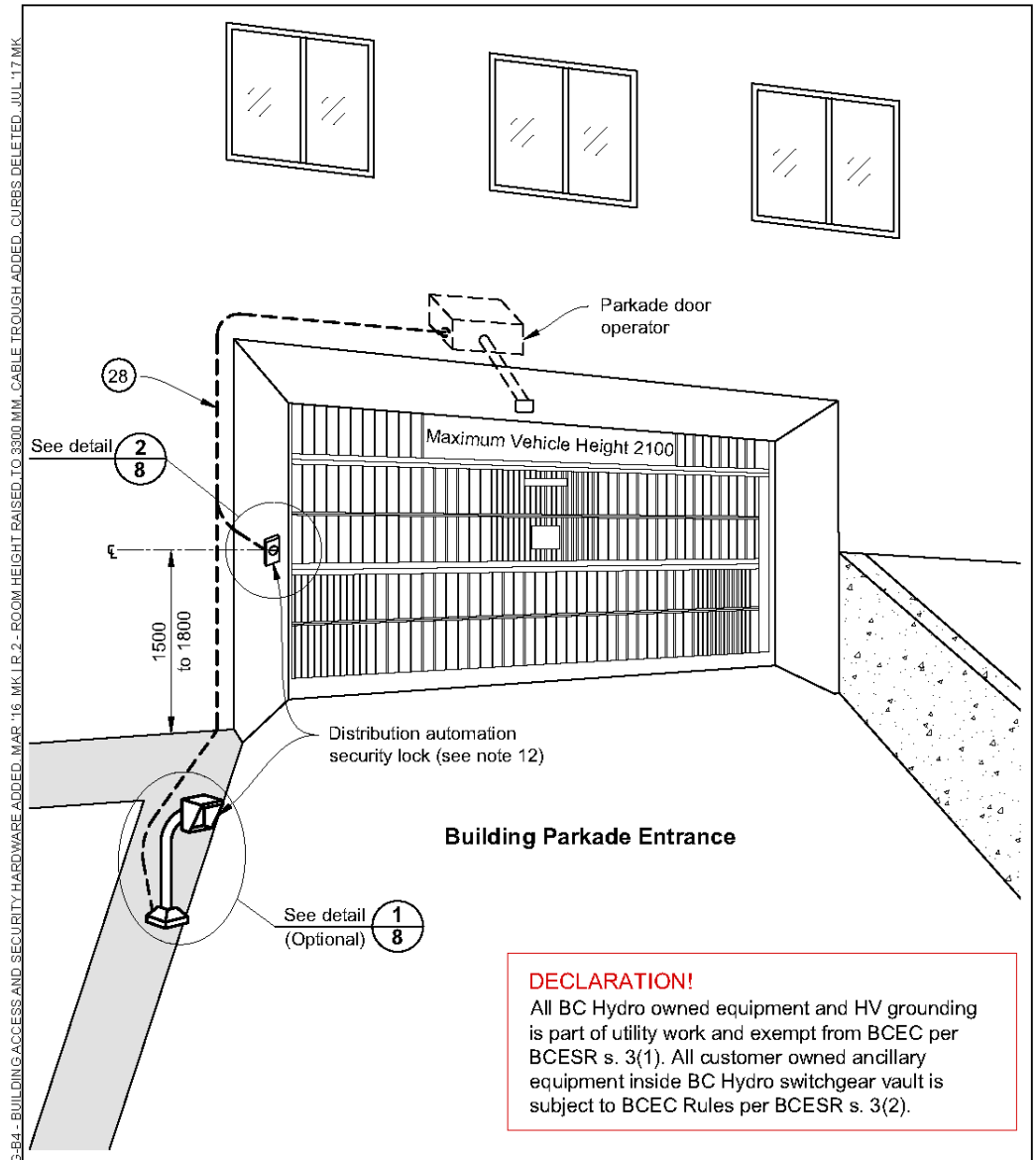
REVISIONS: R.1 - HIGH FLOOD LEVEL SERVICE ADDED AND DIMENSIONS CHANGED. AUG '17 MK

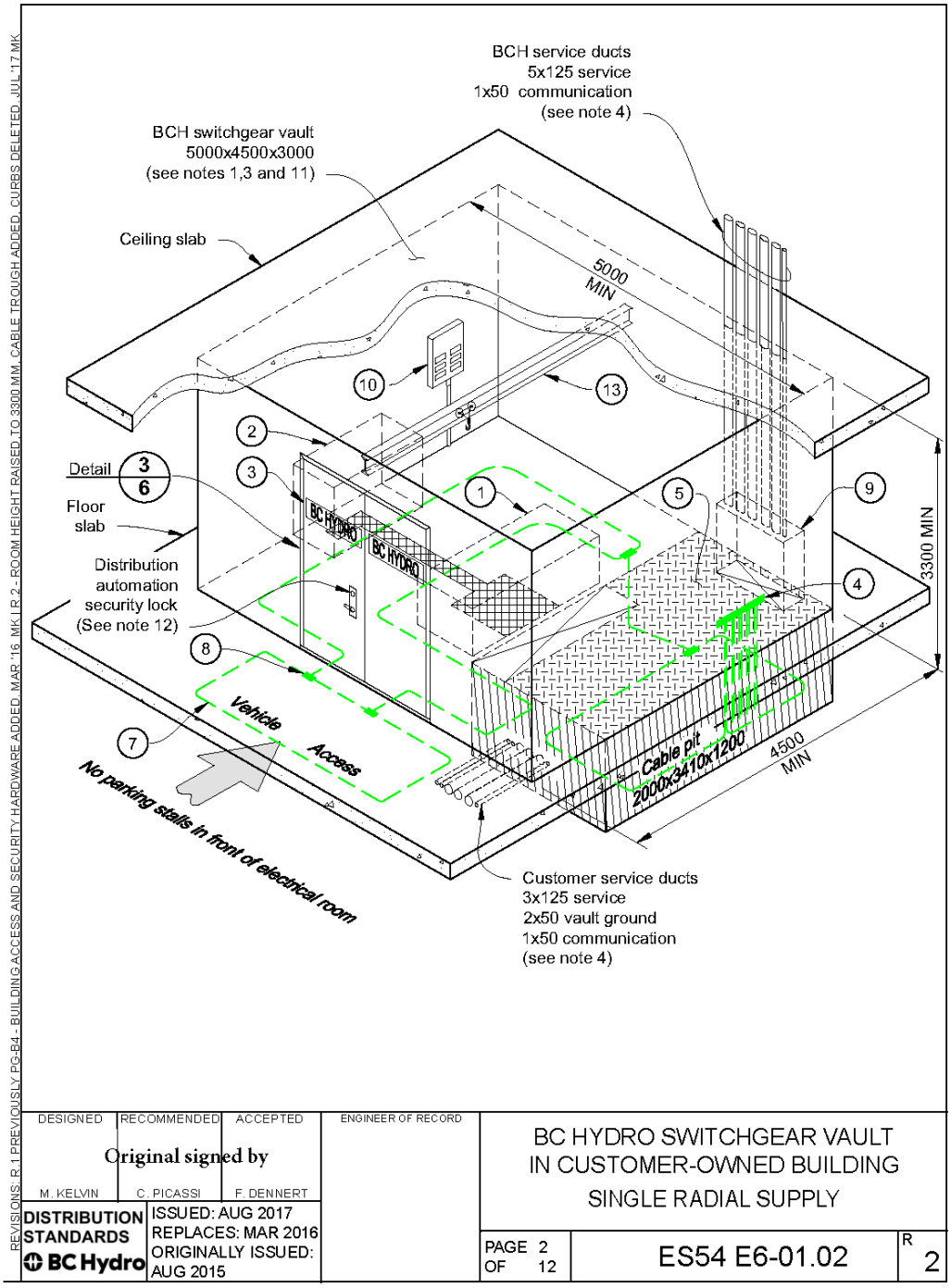
DESIGNED	RECOMMENDED	ACCEPTED	ENGINEER OF RECORD	PRIMARY SERVICES LIVE-FRONT INDOOR TYPE SWITCHGEAR PRIVATE PROPERTY INSTALLATION	
Original signed by					
M. KELVIN	A. NORRIS	F. DENNERT			
DISTRIBUTION STANDARDS BC Hydro	ISSUED: AUG 2017 REPLACES:MAR 2016 ORIGINALLY ISSUED: MAR 2016			PAGE 9 OF 9	ES54 S3-03.09 R 1

WARNING PLATE BC Hydro Primary Service Cable Marker Plate



ES54 E6-01 BC Hydro Switchgear Vault in Customer-Owned Building Single Radial Supply





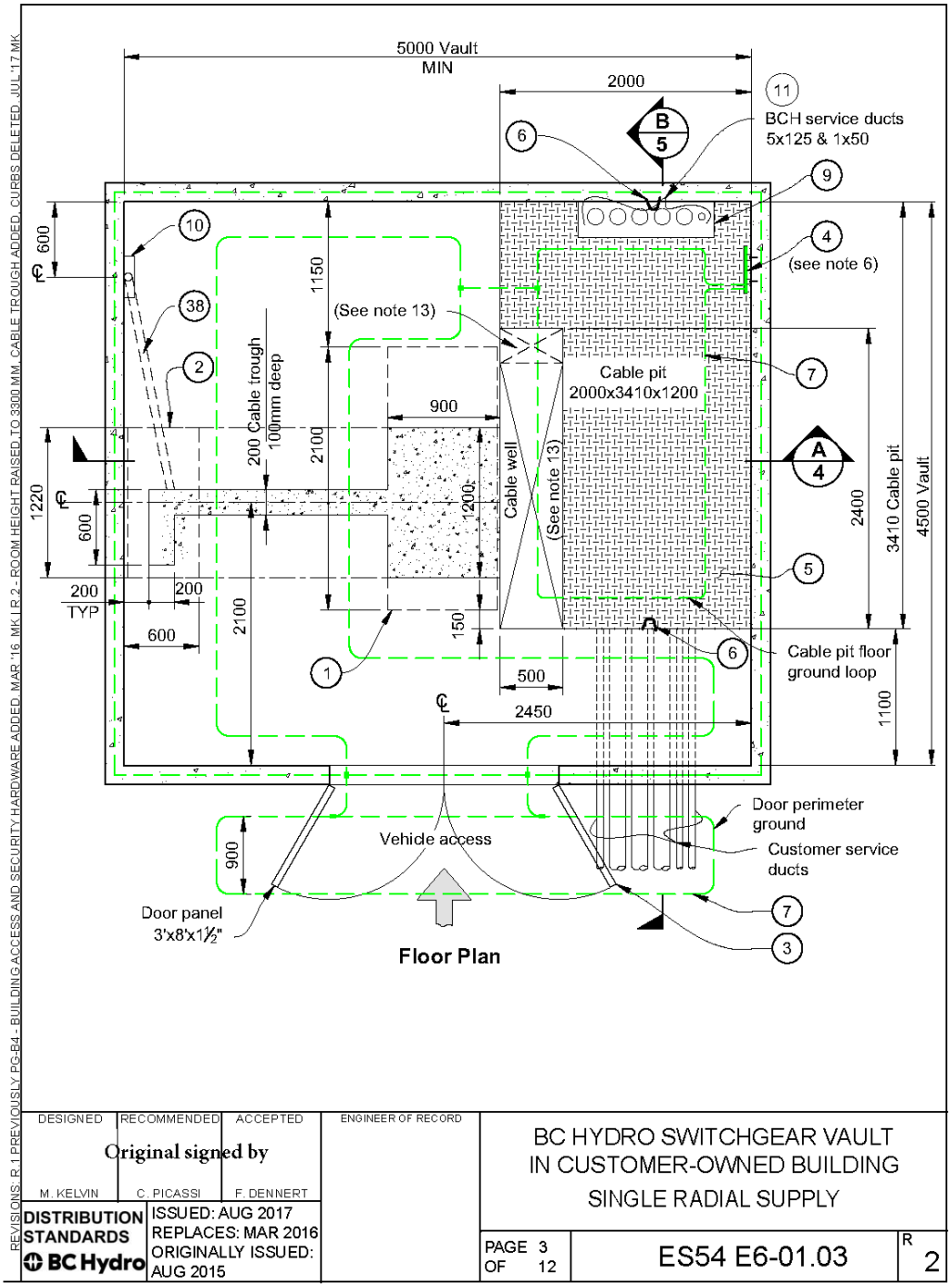
REVISIONS: R.1 PREVIOUSLY PG-B4 - BUILDING ACCESS AND SECURITY HARDWARE ADDED, MAR '16. MK | R.2 - ROOM HEIGHT RAISED TO 3300 MM, CABLE TROUGH ADDED, CURBS DELETED, JUL '17 MK

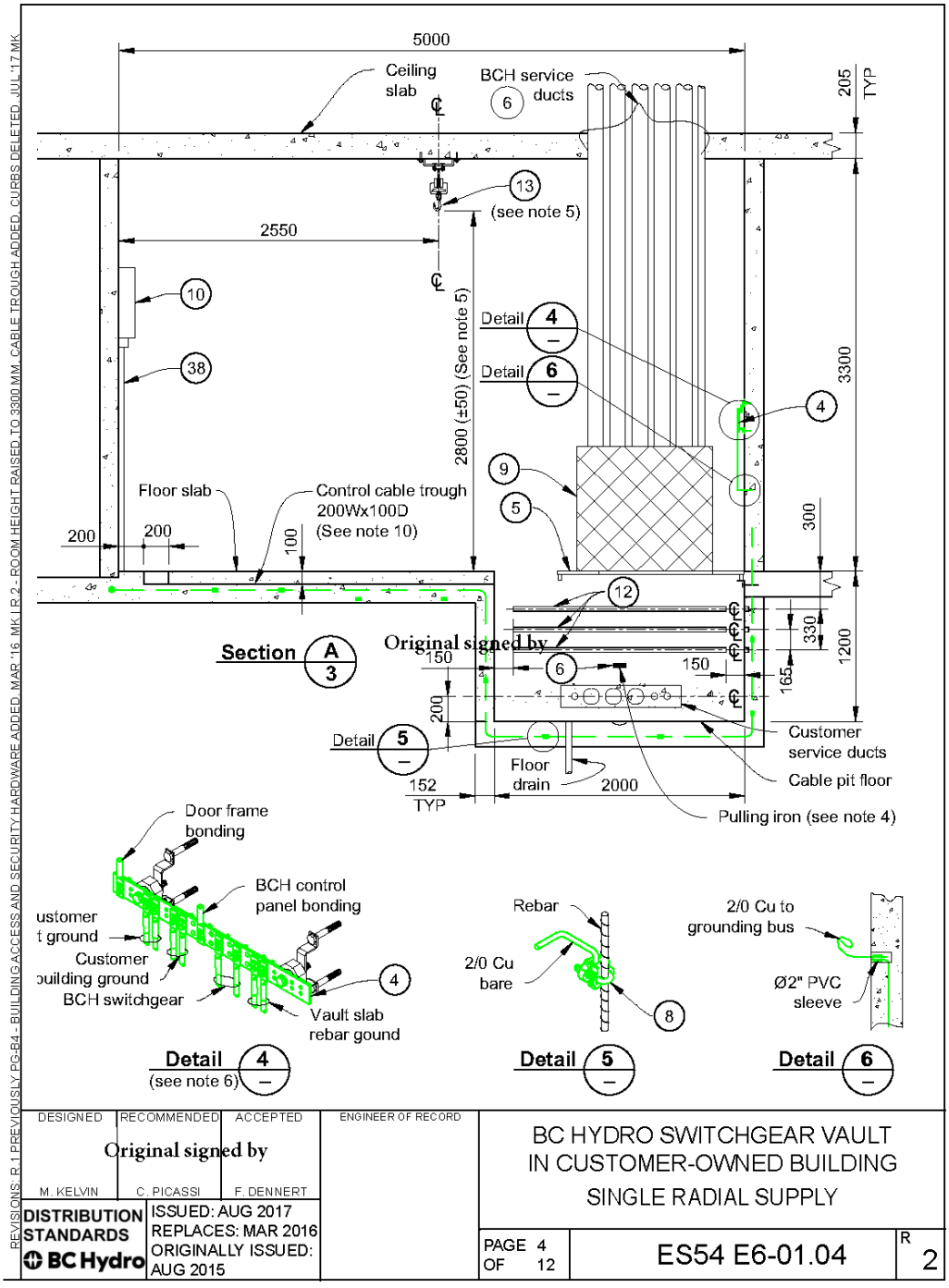
DESIGNED	RECOMMENDED	ACCEPTED	ENGINEER OF RECORD
Original signed by			
M. KELVIN	C. PICASSI	F. DENNERT	

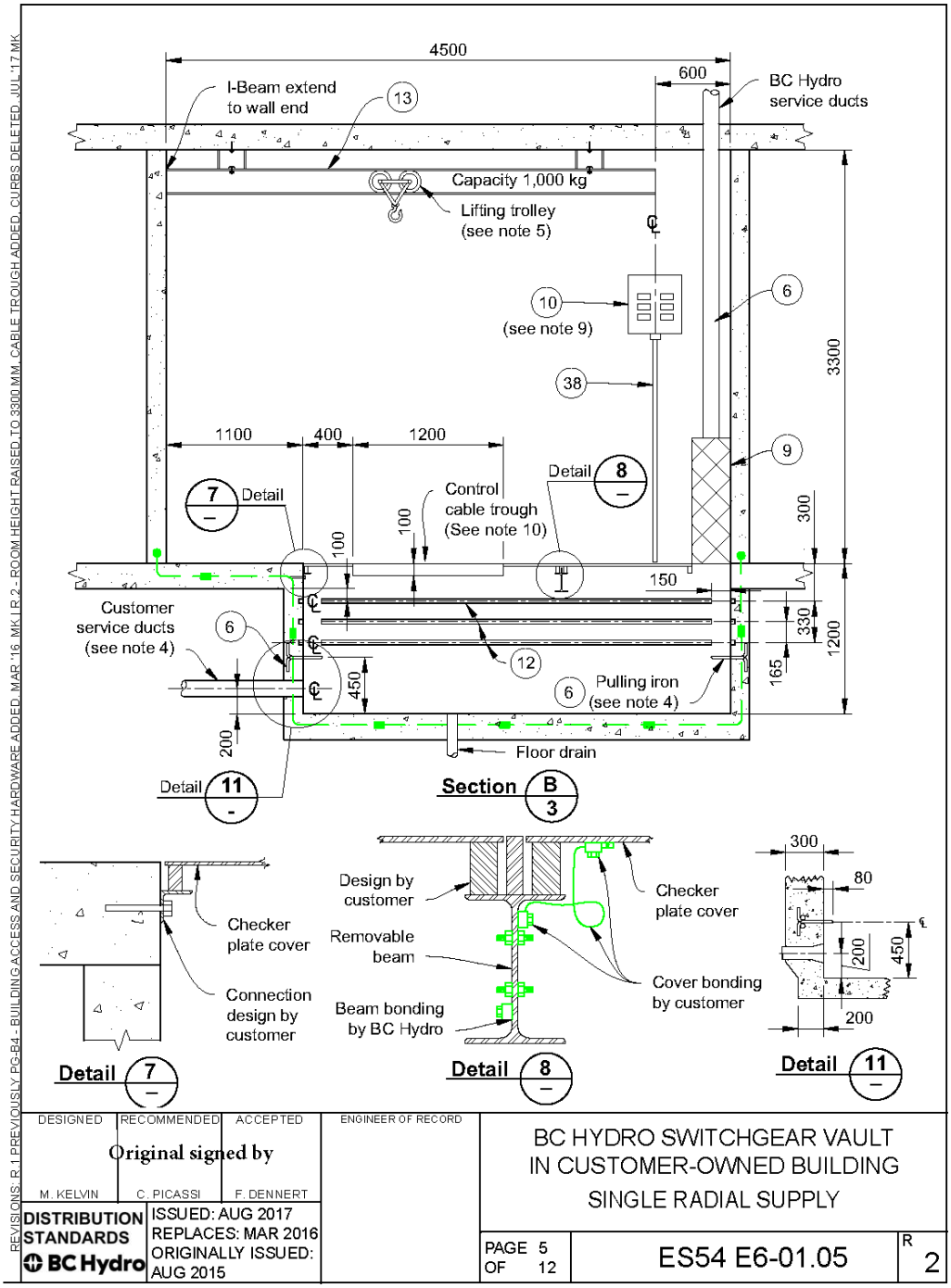
DISTRIBUTION STANDARDS BC Hydro
ISSUED: AUG 2017
REPLACES: MAR 2016
ORIGINALLY ISSUED: AUG 2015

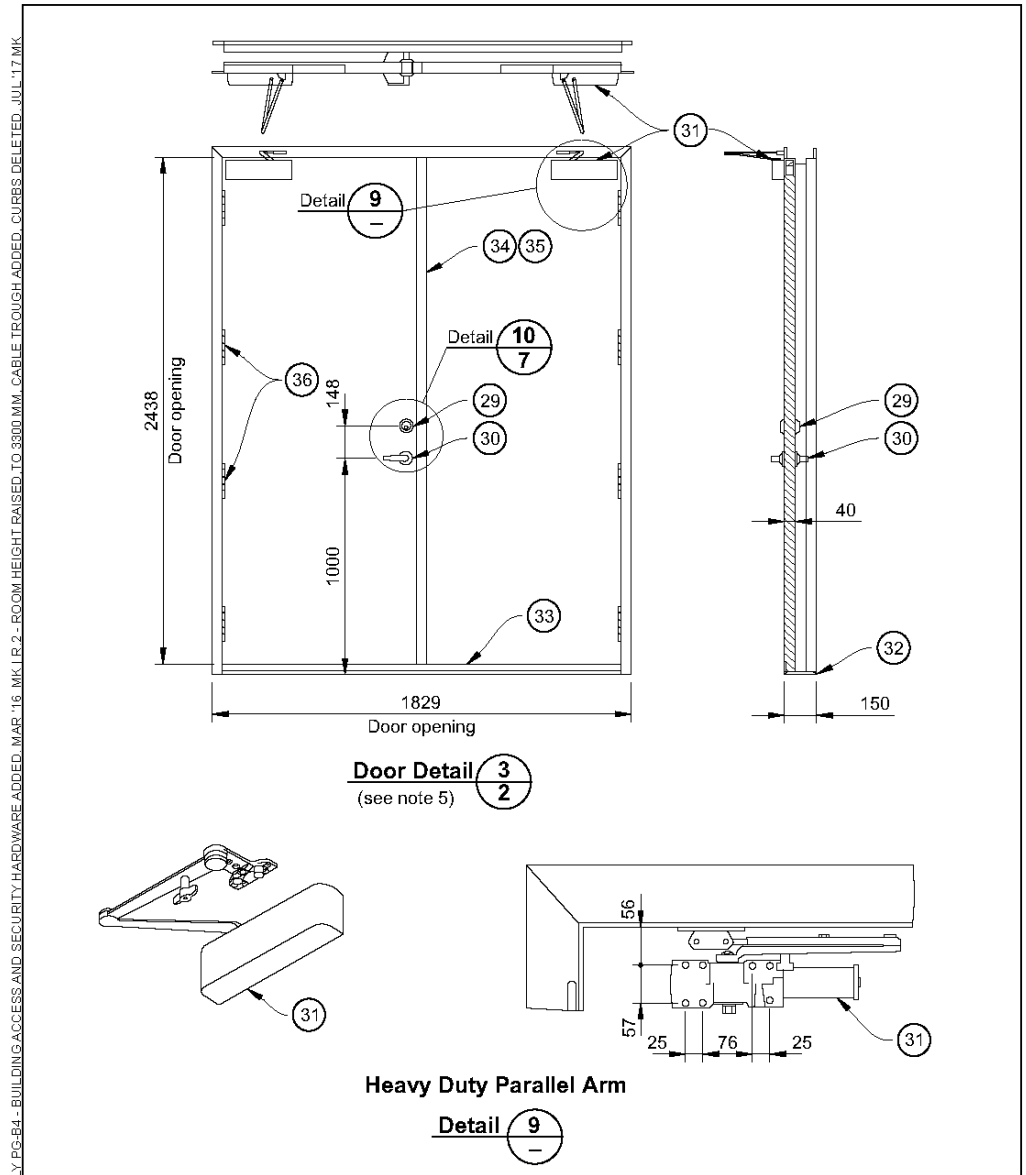
BC HYDRO SWITCHGEAR VAULT
IN CUSTOMER-OWNED BUILDING
SINGLE RADIAL SUPPLY

PAGE 2 OF 12 | ES54 E6-01.02 | R 2

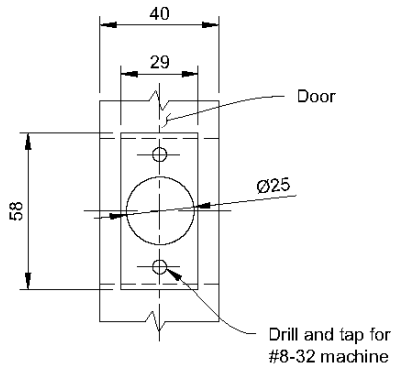




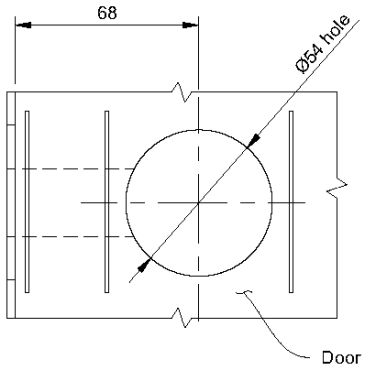




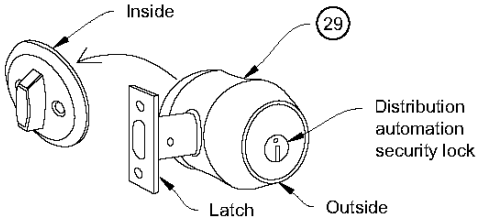
REVISIONS: R.1 PREVIOUSLY PG-B4 - BUILDING ACCESS AND SECURITY HARDWARE ADDED, MAR '16. MK.I R.2 – ROOM HEIGHT RAISED TO 3300 MM. CABLE TROUGH ADDED. CURBS DELETED. JUL '17 MK



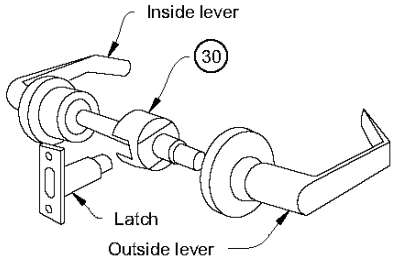
Latch



Drilling Template for Dead Bolt and Storeroom Lever



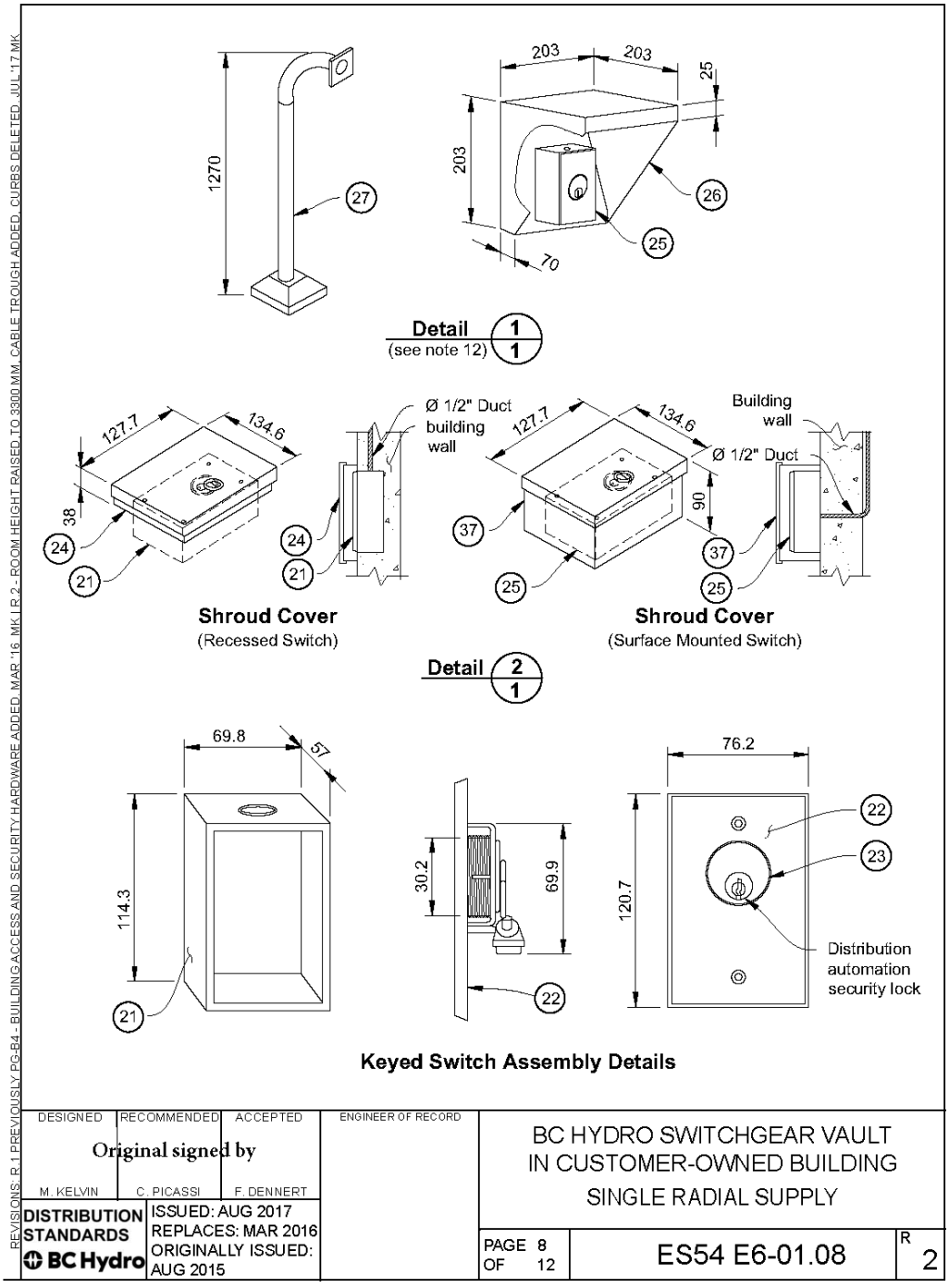
Dead Bolt



Storeroom Lever

Detail 10/6

DESIGNED	RECOMMENDED	ACCEPTED	ENGINEER OF RECORD	BC HYDRO SWITCHGEAR VAULT IN CUSTOMER-OWNED BUILDING SINGLE RADIAL SUPPLY	
Original signed by					
M. KELVIN	C. PICASSI	F. DENNERT			
DISTRIBUTION STANDARDS BC Hydro	ISSUED: AUG 2017 REPLACES: MAR 2016 ORIGINALLY ISSUED: AUG 2015			PAGE 7 OF 12	ES54 E6-01.07 R 2



REVISIONS: R.1 PREVIOUSLY PG-B4 - BUILDING ACCESS AND SECURITY HARDWARE ADDED, MAR '16. MK | R.2 – ROOM HEIGHT RAISED TO 3300 MM, CABLE TROUGH ADDED, CURBS DELETED, JUL '17 MK

Notes

1. The BC Hydro switchgear vault, 5000 W x 4500 D x 3300 H mm minimum dimensions, is intended for 4-way and 5-way switchgear to facilitate the new BC Hydro "Open Loop" configuration for designated customer primary service single radial supply. Alternatively, BC Hydro may use such vaults in areas with highly congested public corridors.
2. Switchgear vaults inside a customer building shall be located at a level not lower than one floor below ground level, namely P1. A pad-mounted switchgear option installed in an alcove or an open parkade is not acceptable to BC Hydro. For further reference and installation options, contact the BC Hydro designer for the area.
3. BC Hydro shall require a specific Right of Way (ROW) for the switchgear area and building access. The customer should prepare the ROW drawing and forward it to the BC Hydro designer. It is the customer's responsibility to provide an as-constructed survey plan to confirm that the switchgear area is within the specific ROW area.
4. The customer shall contact the BC Hydro designer to confirm the exact number of service ducts, size of service cables, and size of the BC Hydro distribution switchgear. Service ducts located inside the building shall be concrete-encased CSA Type DB2 inside a 75 mm cover. For the exposed section of ducts inside a fire-rated vault, the ducts shall be Sched40 steel or 6 mm-thick steel cover plate, removable. The customer may propose an alternative location for the service ducts inside the cable pull pit, which may require relocating the associated pulling irons.
5. The customer shall provide easy vehicle access to the switchgear vault and a double metal door for equipment access, 2 x (3ft x 8ft) fire-rated swing-out doors. The customer shall ensure that the lifting I-beam with a lifting trolley is centred with the centre line of the access door and switchgear mounting centre line. For a high ceiling vault, the lifting trolley shall be fitted with a chain and a 3" dia. lifting ring 2800 (+/-50) mm above the floor.
6. The BC Hydro switchgear vault requires a 4" x 24" x ¼" thick Cu bus for connection to the building ground and customer vault grounding conductors, as well as the BC Hydro switchgear and control panel grounding conductors. In addition, the customer shall bond all exposed metal structures, such as doors, building columns and pull pit metal cover plates, to the ground bus, per CEC Section 36.
7. The BC Hydro switchgear vault requires a relatively large cable pull pit (2000 W x 3410 L x 1200 D) mm, to accommodate multiple cables and to facilitate the cable pulling harness. The cable pull pit shall be covered with removable steel or aluminum 6 mm (¼" thick) checker plates, less than 40 lb in weight (less than 80 lb hinged), c/w drop-down lifting handles, mechanically interlocked or bolted down to the support floor joists. The supporting floor joists and beams shall be removable, designed and installed by the customer for applicable live and dead load ratings.
8. BC Hydro requires three runs of C-channels, Unistrut P-3270, on all four walls inside the cable pull pit. These channels are used for cable clamping, grounding bus installation and support of other equipment.

DESIGNED	RECOMMENDED	ACCEPTED	ENGINEER OF RECORD	BC HYDRO SWITCHGEAR VAULT IN CUSTOMER-OWNED BUILDING SINGLE RADIAL SUPPLY		
Original signed by						
M. KELVIN	C. PICASSI	F. DENNERT				
DISTRIBUTION STANDARDS BC Hydro	ISSUED: AUG 2017 REPLACES: MAR 2016 ORIGINALLY ISSUED: AUG 2015			PAGE 9 OF 12	ES54 E6-01.09	R 2

REVISIONS: R.1 PREVIOUSLY PG-B4 - BUILDING ACCESS AND SECURITY HARDWARE ADDED, MAR '16. MK | R.2 – ROOM HEIGHT RAISED TO 3300 MM, CABLE TROUGH ADDED, CURBS DELETED, JUL '17 MK

9. BC Hydro requires a reliable power supply, a 60 A 120/240 V breaker panel fed from the building essential supply powering the elevators, emergency lighting, etc. The breaker panel shall include one 30 A 120/240 V circuit for the switchgear control panel, two 15 A 120 V circuits for convenience outlets and one 15 A 120 V circuit for lighting.
10. The BC Hydro switchgear and control panel require a recessed cable trough (200 W x 100 D) mm, covered with a removable checker plate and installed between the switchgear base and control panel mounting base. The recessed cable trough widens below the switchgear and control panel, as shown on drawings.
11. The customer's certified building permit drawings shall include the BC Hydro switchgear vault designed to comply with the BC Building Code, BC Electrical Code, and local bylaws and regulations.
12. For wiring and installation details of keyed switches for the building vehicle access via the parkade, contact the BC Hydro designer, or the security access contractor, Gunnebo Canada Inc., at tel. 604-291-1725.
13. The BC Hydro switchgear and cable well dimensions shown are for a 5-way configuration. For smaller 4-way switchgear, the customer shall supply and install a removable engineered cover checker plate, 300x500 mm approximately, for a reduced size cable well.

DESIGNED	RECOMMENDED	ACCEPTED	ENGINEER OF RECORD	BC HYDRO SWITCHGEAR VAULT IN CUSTOMER-OWNED BUILDING SINGLE RADIAL SUPPLY	
M. KELVIN	Original signed by C. PICASSI	F. DENNERT			
DISTRIBUTION STANDARDS BC Hydro	ISSUED: AUG 2017 REPLACES: MAR 2016 ORIGINALLY ISSUED: AUG 2015			PAGE 10 OF 12	ES54 E6-01.10 R 2

REVISIONS: R.1 PREVIOUSLY PG-B4 - BUILDING ACCESS AND SECURITY HARDWARE ADDED, MAR '16. MK I R.2 – ROOM HEIGHT RAISED TO 3800 MM, CABLE TROUGH ADDED, CURBS DELETED, JUL '17 MK

Bill of Material

Item	Description	Catalogue ID	Quantity	Supplied By
1	BC Hydro distribution switchgear	TBD	1	BC Hydro
2	Switchgear control panel	TBD	1	BC Hydro
3	2 x (3ft x 8ft) double swing doors, hand operated, fire rated, c/w safety pins, suitable for BCH supplied deadbolt	N/A	1	Contractor
4	Ground bus 24"x4"x1/4" NEMA spacing, c/w support insulators, wall mount Burndy BBB424UD, Erico EGBA14424 or BC Hydro approved equivalent	N/A	1	Contractor
5	Checker plate floor panels, ¼" Al or steel, removable, 40 lb max, bolted on top of floor joists and removable support beams	N/A	As required	Contractor
6	Pulling iron, Slater Products Inc. hot dip galvanized Cat. No. 9119	420-0916	2	BC Hydro
7	2/0 AWG Cu bare stranded	N/A	As required	Contractor
8	2/0 Cu to ¾" rebar grounding connector Ilsco GPL-6 or T&B 54890 C-tap or equivalent	N/A	As required	Contractor
9	Cable guard, removable, steel 12 Ga, bolted to wall	N/A	1	Contractor
10	Distribution sub-panel 60 A 120/240 V 6 cct	N/A	1	Contractor
11	Rigid steel duct 125 mm dia Schedule 40	N/A	As required	Contractor
12	C-channel Unistrut P-3270	N/A	As required	Contractor
13	I-beam lifter, 1,000 kg capacity c/w lifting trolley	N/A	1	Contractor
17	Future use			
21	Single gang switch box	N/A	1	Contractor
22	Distribution Automation Key Switch, as required	N/A	1 (or more)	Gunnebo
23	Medeco 3 Logic 1⅛" mortise cylinder	N/A	1	Gunnebo
24	Shroud enclosure for Distribution Automation lock for embedded switch CUS-BCH-SMKSC-SS-1.5	N/A	1	Gunnebo
25	Surface mount Distribution Automation Key Switch	N/A	1	Gunnebo
26	Hood cover	N/A	1	Gunnebo
27	Pad-mounted goose neck	N/A	1	Gunnebo
28	½" PVC conduit c/w pull string 18 Ga	N/A	1	Contractor
29	Deadbolt Medeco MD11C60226 kGC	N/A	1	Gunnebo
30	Storeroom lever door handle	N/A	1	Gunnebo
31	Door closer	N/A	2	Gunnebo
32	Door bottom	N/A	2	Gunnebo

DESIGNED	RECOMMENDED	ACCEPTED	ENGINEER OF RECORD	BC HYDRO SWITCHGEAR VAULT IN CUSTOMER-OWNED BUILDING SINGLE RADIAL SUPPLY	
Original signed by					
M. KELVIN	C. PICASSI	F. DENNERT			
DISTRIBUTION STANDARDS BC Hydro	ISSUED: AUG 2017 REPLACES: MAR 2016 ORIGINALLY ISSUED: AUG 2015			PAGE 11 OF 12	ES54 E6-01.11 R 2

REVISIONS: R.1 PREVIOUSLY PG-B4 - BUILDING ACCESS AND SECURITY HARDWARE ADDED, MAR '16, MK | R.2 - ROOM HEIGHT RAISED TO 3300 MM, CABLE TROUGH ADDED, CURBS DELETED, JUL '17 MK

Bill of Material, contd.

Item	Description	Catalogue ID	Quantity	Supplied By
33	Threshold ½" x 6" x 72"	N/A	1	Contractor
34	Astragal MHASH5052188	N/A	1	Contractor
35	Flush bolt set DC840C15, top and bottom	N/A	2	Contractor
36	NRP hinges MYTA2714NPR26D	N/A	8	Contractor
37	Shroud enclosure for key switch c/w ¼ turn lock for surface mount switch CUS-BCH-SMKSC-SS-3.5	N/A	1	Gunnebo
38	2"dia PVC duct	N/A	As required	Contractor

Reference Document

BC Hydro Requirements for Customer-Owned Primary Services Supplied at 4 kV to 35 kV – "Primary Guide"

Reference Standards

ES55 B2-05	BC Hydro Owned Switchgear in Customer-Owned Buildings
ES53 E4-01	12 kV and 25 kV Dead-Front Switchgear Installation, Above Ground 4 and 5 Way Over-Vault
ES54 Section R	Grounding
ES54 S3-03	Primary Services, Live Front Indoor Type Switchgear
CSA22.1	Canadian Electrical Code, Part I

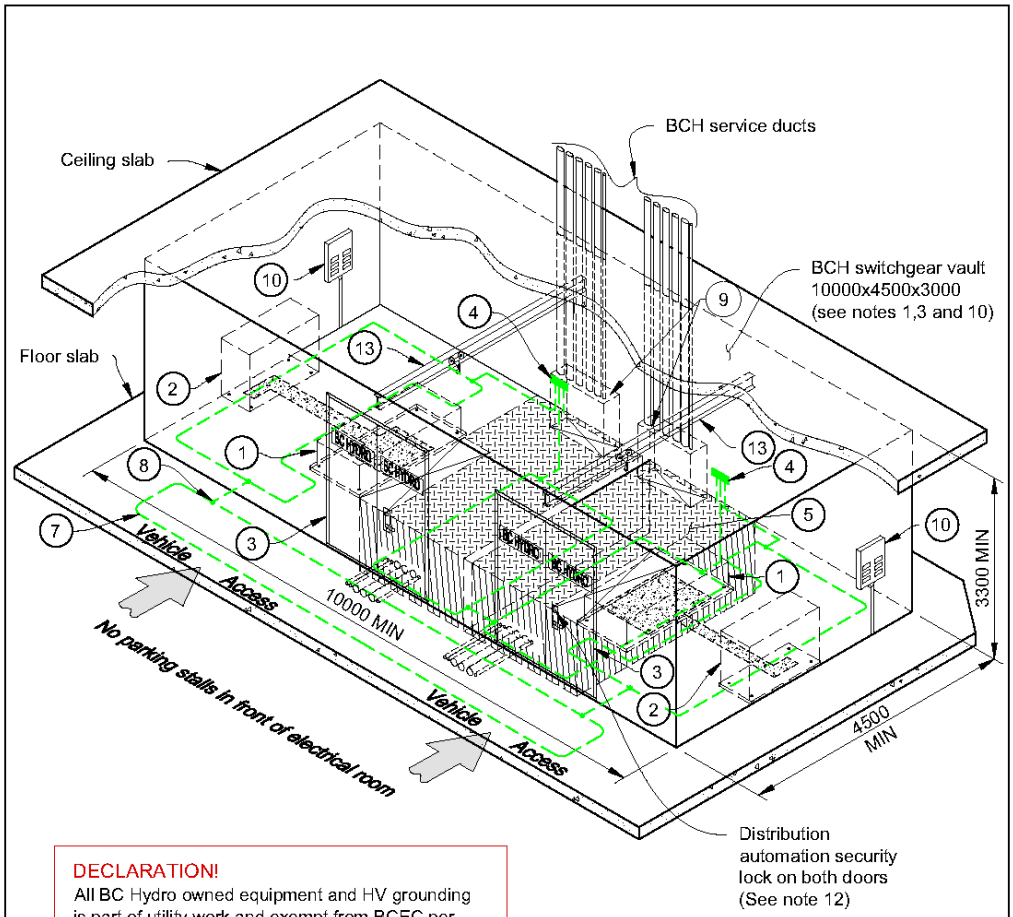
DESIGNED	RECOMMENDED	ACCEPTED	ENGINEER OF RECORD
Original signed by			
M. KELVIN	C. PICASSI	F. DENNERT	

DISTRIBUTION STANDARDS BC Hydro | ISSUED: AUG 2017 REPLACES: MAR 2016 ORIGINALLY ISSUED: AUG 2015

BC HYDRO SWITCHGEAR VAULT IN CUSTOMER-OWNED BUILDING SINGLE RADIAL SUPPLY

PAGE 12 OF 12 | ES54 E6-01.12 | R 2

ES54 E6-02 BC Hydro Switchgear Vault in Customer-Owned Building Dual Supply

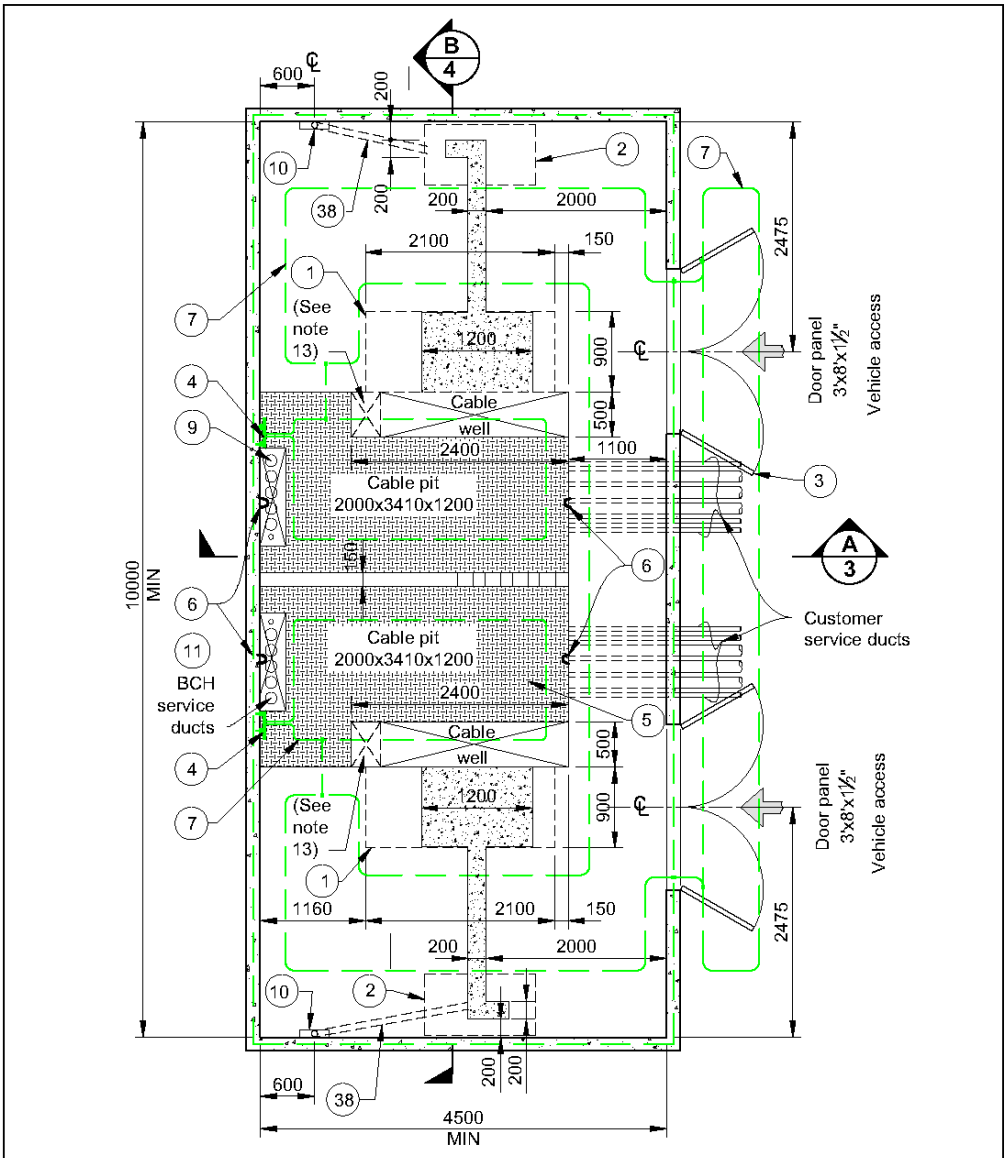


DECLARATION!
All BC Hydro owned equipment and HV grounding is part of utility work and exempt from BCEC per BCESR s. 3(1). All customer owned ancillary equipment inside BC Hydro switchgear vault is subject to BCEC Rules per BCESR s. 3(2).

Note: For further details on grounding, access security, etc. refer to ES54 E6-01

REVISIONS: R.1 - ROOM HEIGHT RAISED TO 3300 MM, CABLE TROUGH ADDED, CURBS DELETED. JUL '17 MK

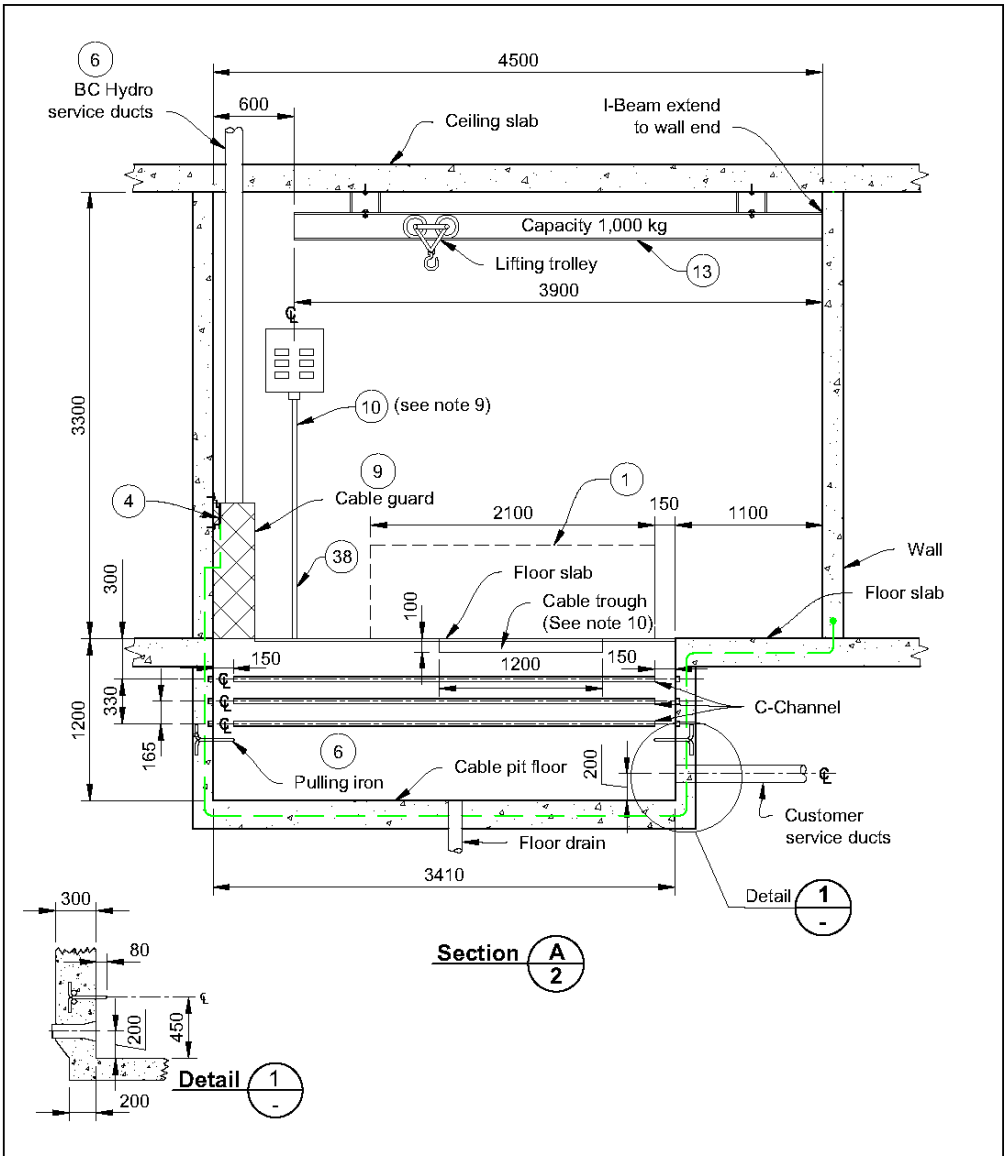
DESIGNED	RECOMMENDED	ACCEPTED	ENGINEER OF RECORD	BC HYDRO SWITCHGEAR VAULT IN CUSTOMER-OWNED BUILDING DUAL SUPPLY	
Original signed by					
M. KELVIN	L. STEVANOVIC	F. DENNERT			
DISTRIBUTION STANDARDS BC Hydro	ISSUED: AUG 2017 REPLACES: MAR 2016 ORIGINALLY ISSUED: MAR 2016			PAGE 1 OF 7	ES54 E6-02.01 R 1



Plan

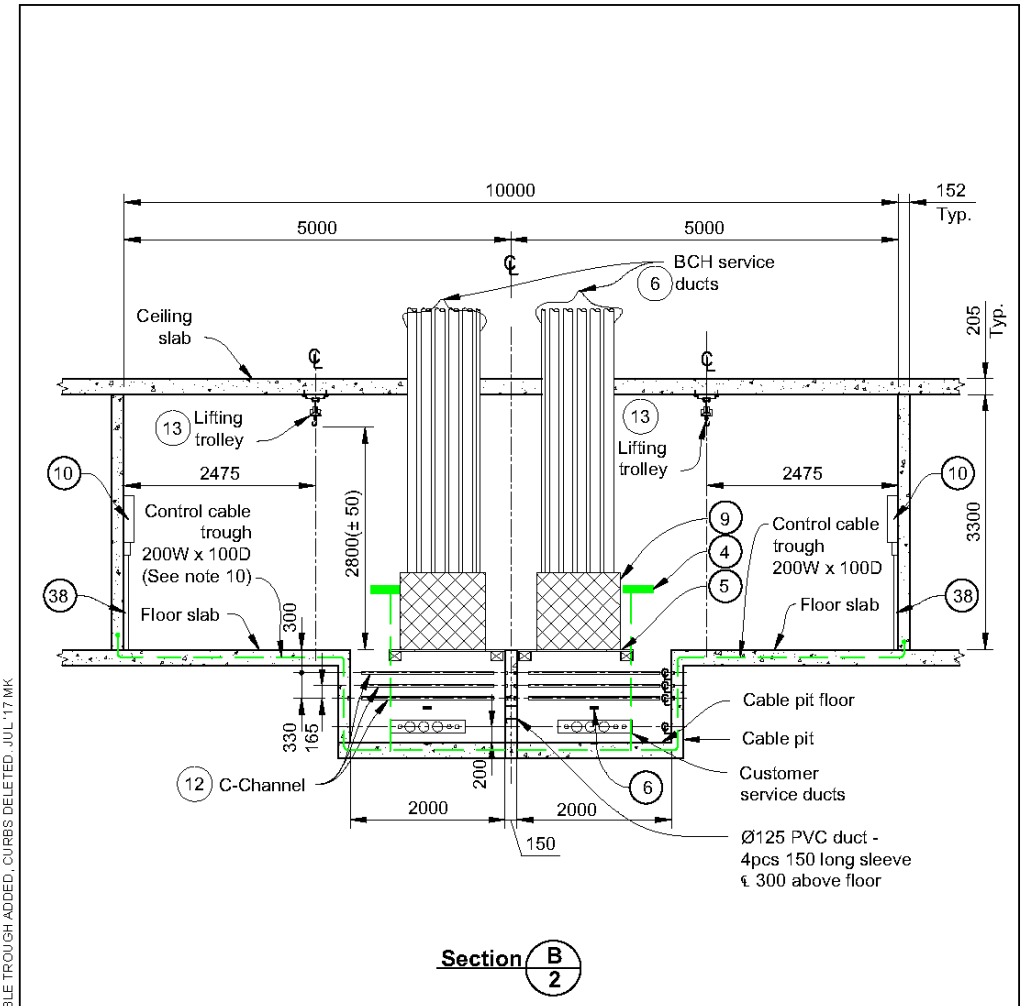
REVISIONS: R.1 - ROOM HEIGHT RAISED, TO 3300 MM, CABLE TROUGH ADDED, CURBS DELETED. JUL.'17 MK

DESIGNED	RECOMMENDED	ACCEPTED	ENGINEER OF RECORD	BC HYDRO SWITCHGEAR VAULT IN CUSTOMER-OWNED BUILDING DUAL SUPPLY	
Original signed by					
M. KELVIN	L. STEVANOVIC	F. DENNERT			
DISTRIBUTION STANDARDS BC Hydro	ISSUED: AUG 2017 REPLACES: MAR 2016 ORIGINALLY ISSUED: MAR 2016			PAGE 2 OF 7	ES54 E6-02.02 R 1



REVISIONS: R.1 - ROOM HEIGHT RAISED TO 3300 MM, CABLE TROUGH ADDED, CURBS DELETED. JUL'17 MK

DESIGNED	RECOMMENDED	ACCEPTED	ENGINEER OF RECORD	BC HYDRO SWITCHGEAR VAULT IN CUSTOMER-OWNED BUILDING DUAL SUPPLY	
Original signed by					
M. KELVIN	L. STEVANOVIC	F. DENNERT			
DISTRIBUTION STANDARDS BC Hydro	ISSUED: AUG 2017 REPLACES: MAR 2016 ORIGINALLY ISSUED: MAR 2016			PAGE 3 OF 7	ES54 E6-02.03 R 1



Section B 2

REVISIONS: R.1 - ROOM HEIGHT RAISED, TO 3300 MM, CABLE TROUGH ADDED, CURBS DELETED. JUL.'17 MK

DESIGNED	RECOMMENDED	ACCEPTED	ENGINEER OF RECORD	BC HYDRO SWITCHGEAR VAULT IN CUSTOMER-OWNED BUILDING DUAL SUPPLY	
Original signed by					
M. KELVIN	L. STEVANOVIC	F. DENNERT			
DISTRIBUTION STANDARDS BC Hydro	ISSUED: AUG 2017 REPLACES: MAR 2016 ORIGINALLY ISSUED: MAR 2016			PAGE 4 OF 7	ES54 E6-02.04 R 1

Notes

1. This standard presents BC Hydro specific requirements for a large customer primary supply service, which requires dual supply using BC Hydro owned switchgear per ES54 E6-01. Design details, vault dimensions, general requirements and Bill of Materials remain the same as listed in ES54 E6-01 standards.
2. Dual supply switchgear vaults inside a customer building shall be located at a level not lower than one floor below ground level, namely P1. A pad-mounted switchgear option installed in an alcove or an open parkade is not acceptable to BC Hydro. For specific requirements for building access via overhead door, refer to ES54 E6-01 standards.
3. BC Hydro shall require a specific Right of Way (ROW) for the switchgear area and building access. The customer should prepare the ROW drawing and forward it to the BC Hydro designer. It is the customer's responsibility to provide an as-constructed survey plan to confirm that the switchgear area is within the specific ROW area.
4. The customer shall contact the BC Hydro designer to confirm the exact number of service ducts for each switchgear, size of service cables, and size of BC Hydro switchgear. Service ducts located inside the building shall be concrete-encased CSA Type DB2 inside a 75 mm cover. For the exposed section of ducts inside a fire-rated vault, the ducts shall be Sched40 steel or 6 mm-thick steel cover plate, removable. The customer may propose an alternative location for the service ducts inside each cable pull pit, which may require relocating the associated pulling irons.
5. The customer shall provide easy vehicle access to the switchgear vault and two separate sets of double metal doors for equipment access, 2 x (3ft x 8ft) fire-rated swing-out doors. The customer shall ensure that the lifting I-beam with a lifting trolley is centred with the centre line of each access door and the switchgear mounting centre line. For a high ceiling vault, the lifting trolley shall be fitted with a chain and a 3" dia. lifting ring at elevation 2800 (+/-50) mm above the floor.
6. Each BC Hydro switchgear vault requires a 4" x 24" x ¼" thick Cu bus for connection to the building ground and customer vault grounding conductors, as well as the BC Hydro switchgear and control panel grounding conductors. In addition, the customer shall bond all exposed metal structures, such as doors, building columns and pull pit metal cover plates, to the corresponding ground bus, per CEC Section 36.
7. Both switchgear units require a separate cable pull pit (2000 W x 3410 L x 1200 D) mm with a minimum 150 mm (6" thick) concrete curb wall as a safety barrier in the event that one supply is shut off. Each cable pull pit shall be covered with removable steel or aluminum 6 mm (¼" thick) checker plates, less than 40 lb in weight (less than 80 lb hinged), c/w drop-down lifting handles, mechanically interlocked or bolted down to the floor joists. The supporting floor joists and beams shall be removable, designed and installed by the customer for applicable live and dead load ratings.
8. BC Hydro requires three runs of C-channels, Unistrut P-3270, on all four walls inside both cable pull pits. These channels are used for cable clamping, grounding bus installation and support of other equipment.

REVISIONS: R.1 - ROOM HEIGHT RAISED,TO 3300 MM, CABLE TROUGH ADDED, CURBS DELETED. JUL.'17 MK

DESIGNED	RECOMMENDED	ACCEPTED	ENGINEER OF RECORD	BC HYDRO SWITCHGEAR VAULT IN CUSTOMER-OWNED BUILDING DUAL SUPPLY	
Original signed by					
M. KELVIN	L. STEVANOVIC	F. DENNERT			
DISTRIBUTION STANDARDS BC Hydro	ISSUED: AUG 2017 REPLACES: MAR 2016 ORIGINALLY ISSUED: MAR 2016			PAGE 5 OF 7	ES54 E6-02.05 R 1

9. BC Hydro requires two separate power supply 60 A 120/240 V breaker panels fed from the building essential supply powering the elevators, emergency lighting, etc. Each breaker panel shall include one 30 A 120/240 V circuit for the switchgear control panel, two 15 A 120 V circuits for convenience outlets and one 15 A 120 V circuit for lighting.
10. The BC Hydro switchgear and control panels require a recessed cable trough (200 W x 100 D) mm, covered with a removable checker plate and installed between the switchgear base and control panel mounting base. The recessed cable trough widens below the switchgear and control panel as shown on the drawings.
11. The customer's certified building permit drawings shall include the BC Hydro switchgear vault designed to comply with the BC Building Code, BC Electrical Code, and local bylaws and regulations. Accordingly, the dual supply switchgear vault shall display a large warning sign "Power supplied from Two Separate Sources."
12. For wiring and installation details of keyed switches for the building vehicle access via the parkade, contact the BC Hydro designer, or the security access contractor, Gunnebo Canada Inc., at tel. 604-291-1725.
13. The BC Hydro switchgear and cable well dimensions shown are for a 5-way configuration. For smaller 4-way switchgear, the customer shall supply and install a removable engineered cover checker plate, 300x500 mm approximately, for a reduced size cable well.

Bill of Material

Item	Description	Catalogue ID	Quantity	Supplied By
1	BC Hydro distribution switchgear	TBD	1	BC Hydro
2	Switchgear control panel	TBD	1	BC Hydro
3	2 x (3ft x 8ft) double swing doors, hand operated, fire rated, c/w safety pins, suitable for BCH supplied deadbolt	N/A	1	Contractor
4	Ground bus 24"x4"x1/4" NEMA spacing, c/w support insulators, wall mount Burndy BBB424UD, Erico EGBA14424 or BC Hydro approved equivalent	N/A	1	Contractor
5	Checker plate floor panels, ¼" Al or steel, removable, 40 lb max, bolted on top of floor joists and removable support beams	N/A	As required	Contractor
6	Pulling iron, Slater Products Inc. hot dip galvanized Cat. No. 9119	420-0916	2	BC Hydro
7	2/0 AWG Cu bare stranded	N/A	As required	Contractor
8	2/0 Cu to ¾" rebar grounding connector Ilsco GPL-6 or T&B 54890 C-tap or equivalent	N/A	As required	Contractor
9	Cable guard, removable, steel 12 Ga, bolted to wall	N/A	1	Contractor

REVISIONS: R.1 - ROOM HEIGHT RAISED, TO 3300 MM, CABLE TROUGH ADDED, CURBS DELETED. JUL.'17 MK

DESIGNED	RECOMMENDED	ACCEPTED	ENGINEER OF RECORD
Original signed by			
M. KELVIN	L. STEVANOVIC	F. DENNERT	

DISTRIBUTION STANDARDS BC Hydro | ISSUED: AUG 2017 REPLACES: MAR 2016 ORIGINALLY ISSUED: MAR 2016

BC HYDRO SWITCHGEAR VAULT IN CUSTOMER-OWNED BUILDING
DUAL SUPPLY

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Bill of Material, contd.

Item	Description	Catalogue ID	Quantity	Supplied By
10	Distribution sub-panel 60 A 120/240 V 6 cct	N/A	1	Contractor
11	Rigid steel duct 125 mm dia. Schedule 40	N/A	As required	Contractor
12	C-channel Unistrut P-3270	N/A	As required	Contractor
13	I-beam lifter, 1,000 kg capacity c/w lifting trolley	N/A	1	Contractor
17	Future use			
21	Single gang switch box	N/A	1	Contractor
22	Distribution Automation Key Switch, as required	N/A	1 (or more)	Gunnebo
23	Medeco 3 Logic 1⅛" mortise cylinder	N/A	1	Gunnebo
24	Shroud enclosure for Distribution Automation lock for embedded switch CUS-BCH-SMKSC-SS-1.5	N/A	1	Gunnebo
25	Surface mount Distribution Automation Key switch	N/A	1	Gunnebo
26	Hood cover	N/A	1	Gunnebo
27	Pad-mounted goose neck	N/A	1	Gunnebo
28	½" PVC conduit c/w pull string 18 Ga	N/A	1	Contractor
29	Deadbolt Medeco MD11C60226 kGC	N/A	1	Gunnebo
30	Storeroom lever door handle	N/A	1	Gunnebo
31	Door closer	N/A	2	Gunnebo
32	Door bottom	N/A	2	Gunnebo
33	Threshold ½" x 6" x 72"	N/A	1	Contractor
34	Astragal MHASH5052188	N/A	1	Contractor
35	Flush bolt set DC840C15, top and bottom	N/A	2	Contractor
36	NRP hinges MYTA2714NPR26D	N/A	8	Contractor
37	Shroud endosure for key switch c/w ¼ turn lock for surface mount switch CUS-BCH-SMKSC-SS-3.5	N/A	1	Gunnebo
38	2"dia PVC duct	N/A	As required	Contractor

Reference Document

BC Hydro Requirements for Customer-Owned Primary Services Supplied at 4 kV to 35 kV – "Primary Guide".

Reference Standards

ES55 B2-05	BC Hydro Owned Switchgear in Customer-Owned Buildings
ES54 E6-01	BC Hydro Owned Switchgear Vault in Customer-Owned Buildings Single Radial Supply
ES53 E4-01	12 kV and 25 kV Dead Front Switchgear Installation, Above Ground 4 and 5 Way Over-Vault
ES54 Section R	Grounding
ES54 S3-03	Primary Services, Live Front Indoor Type Switchgear
CSA22.1	Canadian Electrical Code, Part I

REVISIONS: R.1 - ROOM HEIGHT RAISED, TO 3300 MM, CABLE TROUGH ADDED, CURBS DELETED. JUL '17 MK

DESIGNED	RECOMMENDED	ACCEPTED	ENGINEER OF RECORD	BC HYDRO SWITCHGEAR VAULT IN CUSTOMER-OWNED BUILDING DUAL SUPPLY	
Original signed by					
M. KELVIN	L. STEVANOVIC	F. DENNERT			
DISTRIBUTION STANDARDS BC Hydro	ISSUED: AUG 2017 REPLACES: MAR 2016 ORIGINALLY ISSUED: MAR 2016			PAGE 7 OF 7	ES54 E6-02.07 R 1

Appendix 3 List of Photographs

Picture 1 – BC Hydro Utility Service Cable Compartment

Picture 2 – Utility Service Cable Compartment Showing Disconnect Switch and Primary Bus Work

Picture 4 - Customer-Owned Primary Service Fuse Compartment

Picture 5 – Primary Revenue Metering Compartment

Picture 6 – Customer Fuse Compartment with Customer Primary Service Cable Terminations

Picture 7 - Customer-Owned Recloser and BC Hydro Primary Revenue Metering

Picture 8 – Customer Service Switch and O/C Protection on First Pole and BC Hydro Primary Revenue Metering on Second Pole

Picture 9 – Customer-Owned Dead Front Kiosk with Both Doors Closed

Picture 10 - Dead Front Kiosk with Both Doors Open - Showing Grounding Switch Above and Service Cable Bushings Below

Picture 11 – Service Cable Clamps and Adjustable Cable Support Channel

Picture 12 – Close-Up of Dead Front BC Hydro Utility Service Cable Compartment with Terminators, Cable Supports and Grounding