SPECIFICATION

FortisBC Specifications for Connection Application for Medium Voltage Equipment (CAMVE)

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1 Disclaimer

1. FortisBC Engineering and Construction Standards are developed and used only for FortisBC designs and construction and for FortisBC distribution facilities only.

2. Some legacy standards may carry the name or logo of “Aquila”, “Aquila Networks Canada”, “UtiliCorp”, “UtiliCorp Networks Canada”, “UNC”, “West Kootenay Power” or “WKP”. Any such references are to be taken as a reference to FortisBC.

3. FortisBC’s expectation is that designs and construction by others (3rd Parties) for any electrical system or distribution facilities adjoining or attaching or otherwise affecting FortisBC distribution facilities shall, at a minimum, meet FortisBC Engineering and Construction Standards.

4. Use of FortisBC Engineering and Construction Standards by any 3rd Party is done at the 3rd Party’s own risk and liability.

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6. FortisBC recommends that any 3rd Party retain the use of a Professional Engineer to assess the completeness of the 3rd Party’s design and construction to meet the minimum requirements.

7. Review and/or comments by FortisBC on any 3rd Party design or construction does not relieve the 3rd Party from full responsibility and liability for the 3rd Party’s design and construction.

8. By requesting and/or accepting copies of any FortisBC Engineering and Construction Standards, the 3rd Party automatically accepts the terms and conditions of this letter.

9. All references to the Canadian Electrical Code (CEC) are made to the 25th edition of the Canadian Electrical Code, Part I, 2021: C22.1-21.

10. All references to the BCEC are made to the “B.C. Electrical Code” per Electrical Safety Regulation, B.C. Reg. 100/2004. The BCEC is the CEC including any amending errata and schedules as adopted by the province. The B.C. Electrical Code is the governing provincial legislation over customer installations and operation of electrical equipment and systems, enforced by TSBC.

2 Scope and Purpose

This document identifies FortisBC's requirements for the design, construction, installation, access, and connection of high-density housing being serviced by customer-owned Primary Services connecting to FortisBC's distribution system at 12kV or 25kV and a total aggregate demand from 2.0 MVA to 6.5 MVA. These services rely on customer-owned Medium Voltage transformation and FortisBC-owned secondary service metering.

This document is intended to provide guidance on FortisBC's requirements, not as an instruction manual for customer-owned Primary Service design. The Customer's Engineering Consultants are ultimately responsible to develop those designs. Safety and reliability are paramount for these installations and should be the Customer's Engineering Consultant's primary concern.

3 Standards and Regulations

Additional standards and regulations that apply to these installations include:

- BCEC;
- CSA C22.2 No. 31-18 Switchgear assemblies;
- CSA C22.2 No. 41-13 (R2017) Grounding and bonding equipment;
- CSA C22.3 No. 7-20 Underground systems;
- CSA C83-17 Communication and power line hardware;
- CSA Z463 Maintenance of Electrical Systems;
- *Engineers and Geoscientists Act*;
- Electrical Safety Regulation;
- Institute of Electrical and Electronics Engineers (IEEE) 80-2013 Guide for Safety in AC Substation Grounding;
- FortisBC Customer Owned MV Equipment P&C Requirements 19June2023
- FortisBC Distribution Standards Manual;
- FortisBC Electric Tariff;
- FortisBC Service and Metering Guide;
- FortisBC Specification for Installation of Underground Conduit Systems;
- Geometric Design Guidelines for B.C. Roads
- Geometric Design Guide for Canadian Roads
- IEEE386-2023 – Standard for Separable Insulated Connector Systems for Power Distribution Systems Rated 2.5 kV to 35 kV
- Occupational Health and Safety Regulation Part 19 Electrical Safety
- *Safety Standards Act*;

- TSBC Directive D-E3 070801 7 Electrical operating permit requirements;
- TSBC Directive D-E3 090313 1 High voltage installations;
- TSBC Directive D-EL 2017-01 Exemptions to public utilities;
- TSBC Information Bulletin IB-EL 2017-04 Electrical safety regulation application to public utilities;

Additional standards may be applicable according to engineering conditions. It is the responsibility of the Customer's Engineering Consultant to ensure all relevant codes, regulations and standards have been met.

As per the BCEC, installations shall meet the Supply Authority's requirements regarding location of high-voltage installations, protection coordination and interconnection arrangements. If customer owned equipment is not compliant with the relevant codes, standards or regulations or otherwise poses a safety or operational risk to the FortisBC distribution system, FortisBC may disconnect the service until the issue has been resolved to FortisBC's satisfaction.

4 Definitions

Annual Operating Permit — a permit to operate, maintain, and carry out minor alterations to the customer-owned Primary Service, as per the B.C. *Safety Standards Act*.

Authority Having Jurisdiction (AHJ) – the regulatory authority that has control over the installation and maintenance of an electrical facility. Refers to TSBC for customer owned Facilities or FortisBC for Supply Authority owned Facilities.

BCEC — the British Columbia Electrical Code is CSA Standard C22.1 Canadian Electrical Code Part I, including amendments by TSBC.

CAMVE – Connection Application for Medium Voltage Equipment. Non-Utility services that receive power at Medium Voltage with multiple FortisBC-owned secondary meters downstream from the Point-of-Connection.

Class A Electrical Field Safety Representative (Class A FSR) — a qualified individual who is certified with TSBC. They are named on every electrical Annual Operating Permit. A Class A FSR can validate completed electrical work and provide assurance that the electrical equipment has been safely installed and is being properly maintained; without voltage or amperage limits.

Cold Load Pickup – high loading occurring after an extended outage due to loss of load diversity.

Coordinating Time Interval (CTI) – the time margin between two protective device trip characteristics used to ensure the downstream protective device has time to detect and clear a fault before the upstream device initiates fault clearing.

CSA Certified or Approved – mark of approval or certificate of compliance for regulated products as required by TSBC Information Bulletin B-E3 071019 3 *Approved Certification Marks for Electrical Products*.

Current Transformer (CT) – a device designed to step-down current flow, certified by Measurement Canada for use in metering.

Customer's Electrical Contractor — the TSBC certified electrical contractor tasked with constructing the electrical facilities or maintaining the facilities after commissioning.

Customer's Engineering Consultant – the EGBC certified engineer or engineering firm tasked with designing and certifying the customer's electrical facilities.

EGBC – Engineers and Geoscientists BC, the regulatory authority for professional engineers and geoscientists in B.C., under the authority of the *Professional Governance Act.*

Entrance Protection – the customer owned protection scheme used to detect faults downstream of the entrance breaker. Entrance protection will trip the entrance breaker to clear faults on the customer MV equipment.

FortisBC Designer — FortisBC agent responsible for processing the customer application for Medium Voltage Service Connection and adherence to FortisBC requirements and distribution standards.

Joint Operating Order — a FortisBC form issued by the Regional Engineer authorizing the CAMVE Service Connection to the FortisBC distribution system and outlining coordination requirements.

Medium Voltage (MV) — voltage greater than 1000 V and up to 34.5 kV, measured phase-to-phase.

Meter Cabinet — a lockable wall-mounted metal box containing a revenue meter certified by Measurement Canada for customer billing purposes.

Point of Common Coupling (PCC) – the point in the power system at which the Supply Authority and the customer interface, as defined by IEEE.

Primary Service — the customer owned service equipment connected to FortisBC, as the Supply Authority, at primary distribution voltage of 4 kV to 35 kV.

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

Primary Service Switchboard — as defined by BCEC standards.

Primary Service Vault — an underground concrete structure for terminating and coiling conductors.

Professional Engineer — a registered professional engineer with qualifications in electrical engineering and registered with EGBC in good standing in B.C.

Pull Box — a concrete box manufactured to meet FortisBC standards and installed to facilitate installation of service cables or conductors.

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

Safety Officer – An individual appointed by the provincial government and employed by TSBC to administer the Safety Standards Act.

Service and Metering Guide — FortisBC's technical guidelines for securing and maintaining an electric service. The most current of this document can be found on the FortisBC web site.

Service Connection — part of FortisBC's distribution facilities extending from the first attachment point on FortisBC's distribution system to the Point of Common Coupling.

Statutory Right-of-Way — a registered right-of-way on private property granted by the customer to FortisBC which allows FortisBC to install and access its equipment in its function as an electric utility.

Supply Authority — as defined in the BCEC.

Supply Service — any one set of conductors run by a Supply Authority from the nearest switching point to a customer'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 to be bolted down and locked by a FortisBC padlock.

Technical Safety B.C. (TSBC) — an organization responsible for administering and enforcing the BCEC in B.C.

Time Curve Characteristic (TCC) Graph – a curve giving the time, as a function of the prospective current under stated conditions of the operations, as per IEC 60050-441.

Vacuum Fault Interrupter (VFI) – a self-contained overcurrent relay and interrupter apparatus that operates to de-energize faults.

5 Application and Acceptance Process

Given the technical complexity and significant load size, and potential resulting impacts on other FortisBC customers, it is important to follow the CAMVE process. Any applications that do not follow the process or fail to meet the process benchmarks may be delayed.

5.1 CAMVE Process

The application process is described in figure 1, below. The FortisBC Customer Design Group will serve as the primary point of contact for the design and construction process.

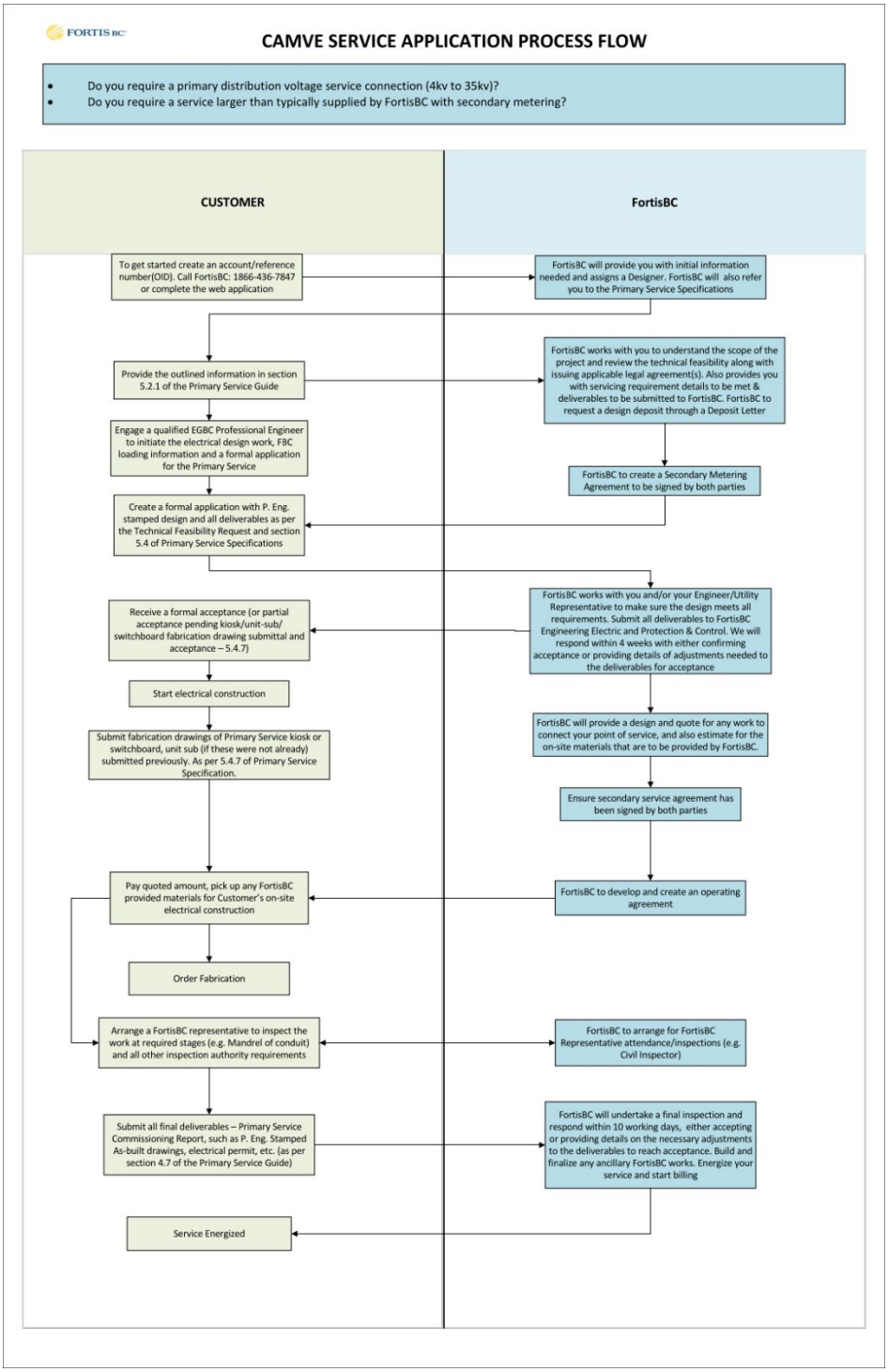

Figure 1 CAMVE Process Flow.

5.2 Preliminary Design

5.2.1 Customer's Engineering Consultant Submission

The Customer's Engineering Consultant should refer to the FortisBC web site for new service connects for the latest information on applying for new or altering an existing CAMVE site.

For additional information please contact a FortisBC Designer. More information is available on the FortisBC New Service Connects webpage. The Customer's Engineering Consultant should have the following information available for submission to FortisBC:

a) devices that may require inrush current mitigation such as large transformers, motors, or pumps;
b) predicted total harmonic distortion for voltage and current;
c) preferred service type (radial/looped);
d) total connected load (in kVA);
e) estimated maximum demand (in kW) as per the FortisBC Service and Metering Guide;
f) high level proposed single line diagram of FortisBC's system included necessary system upgrades and proposed substation feeds,
g) single line diagram of major customer owned equipment (transformers, generators, transfer switches)
h) emergency standby generators,
i) service address; and
j) planned in-service date.

5.2.2 FortisBC Response

The FortisBC Designer shall supply the Customer's Engineering Consultant with the following information:

a) primary supply voltage along with any planned voltage upgrades;
b) service type (e.g., overhead, or underground; radial, or dual supply);
c) current and future system impedance and available fault levels at the service Point-of-Common Coupling;
d) FortisBC switchgear and upstream protection; and
e) designated space for a Statutory Right-of-Way on private property for installation of FortisBC-owned equipment associated with the Primary Service. The customer will survey the designated space and execute the agreement; prepared and registered by FortisBC.

5.3 Secondary Metering Agreement

A secondary metering agreement shall be created by FortisBC and signed by both FortisBC and the customer prior to investment in electric infrastructure. This document establishes ownership responsibilities for customer owned facilities.

The secondary metering agreement shall be completed prior to the Formal Application has been submitted. The FortisBC Design Specialist will help arrange the secondary metering agreement.

5.4 Formal Application

All components of the Formal Application shall be authenticated by a Professional Engineer per EGBC's guidelines. All liability for design and installation of customer owned primary facilities remains with the Customer's Engineering Consultant and the Customer's Electrical Contractor.

Incomplete submissions will be delayed until the full submission has been received and approved.

TSBC's High Voltage (HV) Checklist is a useful reference when preparing the designs, a copy of which can be found on TSBC's web site.

In the event customer owned equipment has been sourced prior to FortisBC's acceptance, the customer shall be responsible for any costs and/or upgrades to meet FortisBC's interconnection requirements. Review of the Formal Application typically will be completed within four weeks from the date of receipt.

5.4.1 Protection & Control Submission Requirements

The preferred format for all documents is PDF.
For preliminary acceptance, the following P&C documentation is required:

- Electrical single line diagram showing voltage levels and equipment ratings and a legend for the following equipment:
    a. entrance switchgear, MV transformer(s), low voltage distribution system, standby; generator(s), and automatic transfer switch(es);
    b. Entrance Protection relay make/model and enabled elements or entrance fuse rating;
    c. MV transformer fuse(s) and ratings;
    d. entrance CT ratio and burden rating and;
    e. cable sizes and quantities.
- Time Curve Characteristic (TCC) graph, showing:
    a. Entrance Protection and FortisBC upstream protection trip characteristics;
    b. MV Transformer(s) inrush curve and;
    c. time measurement at critical CTI (see Section 5.4.2.2).

5.4.2 Acceptable Protection Methods

FortisBC recommends customers utilize digital programmable protection relays for Entrance Protection to allow for fast fault clearing times and adjustability.

FortisBC will accept Entrance Protection schemes utilizing fuses under the following conditions:

a) total connected load is 100 amps or less at the Primary Service voltage, and
b) only one MV transformer will be installed, and
c) adequate coordination with upstream protection can be achieved.

All other installations require a dedicated Entrance Protection relay configured to directly trip an entrance circuit breaker or VFI.

5.4.2.1 Coordination with Upstream Protection

The first upstream FortisBC protective device will generally be a dedicated VFI position on a pad mount or submersible distribution switch. To maintain coordination with other upstream protective devices as well as minimize fault clearing times, FortisBC is unable to adjust the trip characteristics of the upstream device without limitation. For most installations, customer Entrance Protection must be set to coordinate with the upstream trip characteristics detailed in **Error! Reference source not found.**.

Total Connected Transformation	**Upstream Phase Overcurrent Trip Characteristic**
Up to 3000 kVA (12.5kV) Up to 6000 kVA (25kV)	Cooper EF-250 Time Multiplier = 1 Time Adder = 0 Minimum Response Time = 0.05s
Over 3000 kVA, up to 4500kVA (12.5kV) Over 6000 kVA, up to 9000kVA (25kV)	Cooper EF-350 Time Multiplier = 1 Time Adder = 0 Minimum Response Time = 0.05s
Over 4500 kVA (12.5kV) Over 9000 kVA (25kV)	Cooper EF-450 Time Multiplier = 1 Time Adder = 0 Minimum Response Time = 0.05s

Table 1 FortisBC Upstream Trip Characteristic

Ground protection, instantaneous protection and inrush multipliers are not normally implemented in upstream protection.

Use of the characteristics in Table 1 is subject to review for the specific installation and may be adjusted at the discretion of FortisBC.

5.4.2.2 Coordinating Time Interval (CTI)

Entrance protection trip characteristics shall be selected to ensure a minimum 150ms margin is maintained between the customer and the FortisBC upstream protective devices at all fault levels up to the critical CTI.

When Entrance Protection includes instantaneous tripping, the critical CTI is measured at the pickup of the instantaneous element. FortisBC will accept simultaneous clearing with the upstream protective device above the critical CTI. If instantaneous tripping has not been applied, the critical CTI is 120% of the maximum present day fault level.

FortisBC will provide present day fault levels to the customer once the preliminary FortisBC distribution design has been completed.

When a protection relay has been used for Entrance Protection, the 150ms margin shall be maintained between the upstream VFI and Entrance Protection relay trip initiation times.

When fuses have been used for Entrance Protection, the 150ms margin shall be maintained between the upstream VFI trip initiation time and fuse total clearing time.

If the specified CTI cannot be achieved with the trip characteristics specified in **Table 1**, the customer is required to submit a TCC graph showing the specified characteristic and customer Entrance Protection characteristic to FortisBC for review.

5.4.2.3 Pickup Coordination

Entrance protection phase overcurrent trip pickup shall be set no higher than 90% of upstream FortisBC protection pickup to ensure low magnitude faults and overloads result in tripping of the Entrance Protection or downstream device first.

Pickup coordination of ground overcurrent protection is not required.

5.4.2.4 Customer interrupting device requirements

5.4.2.4.1 Fault Duty

The minimum fault interrupting rating, fault closing and short circuit rating requirements for the customer owned entrance breaker/VFI shall be based on table below:

Distribution Voltage (nominal)	Maximum Symmetrical Fault Level
13-kV	12.0 kA
25-kV	12.0 kA

Table 2 Fault Duty Requirements

5.4.2.4.2 Fault Clearing Speed

The minimum fault interrupting speed for the customer owned entrance breaker/VFI shall be 3 cycles. 5 cycle clearing may be acceptable, however increased protective relay CTI will be required. FortisBC review and acceptance of 5 cycle interrupting time is required.

5.4.2.5 Customer Entrance Protection using Relays and Circuit Breakers/VFIs

5.4.2.5.1 Current Transformers

Current Transformers (CTs) used for Entrance Protection should be installed immediately upstream or downstream of the entrance circuit breaker/VFI (upstream preferred). Alternate locations require acceptance by FortisBC.

CTs used for protection purposes shall be protection/relaying class, meeting requirements defined in the latest revisions of CAN/CSA-C60044-1:07 or IEEE C57.13.

CT ratio and burden ratings shall be selected to avoid saturation during expected fault duty.

CT thermal ratings shall be selected to allow full use of downstream equipment current carrying capability under all conditions.

5.4.2.5.2 Entrance Protection Relay

The Entrance Protection relay shall be utility grade rated for the environmental and electrical conditions at the installation location.

Electronic protection relays powered from dedicated Entrance Protection CTs are acceptable. Where external power is required for fault detection and trip initiation, an uninterruptible power source shall be used.

The following protective functions are required:

Protective Function	Description
Phase Time Overcurrent (51P)	Set to coordinate with upstream and downstream protection.
Ground Time Overcurrent (51G)	Set to coordinate with downstream ground and/or phase protection. Set fast and sensitive when downstream MV transformer(s) have delta-high side windings.
Phase Instantaneous Overcurrent (50P)	Typically set to underreach MV Transformer low voltage winding and above MV Transformer inrush.
Ground Instantaneous Overcurrent (50G)	Typically set to underreach MV Transformer low voltage winding and above MV Transformer inrush (if applicable).

Table 3 - Required Protection Relay Protective Functions

At the customer's request, installations with multiple MV transformers may have instantaneous tripping disabled to allow selective clearing of faults by downstream protective devices. customers should consider the infrequent nature of transformer faults against benefits of increased fault clearing speed prior to making this request.

5.4.2.5.3 Cold Load Pickup Considerations

Consideration to incorrect tripping on Cold Load Pickup should be undertaken as part of the Protection Coordination study. Customers who anticipate issues picking up entire facility load in one block must consult with FortisBC to discuss possible solutions.

5.4.2.5.4 Transformer Inrush Considerations

Entrance protection trip characteristics must be set to allow worst case inrush when energizing MV transformer(s). Pessimistic inrush estimates based on 10 times rated winding current may unnecessarily restrict use of instantaneous tripping. Use of realistic inrush values determined using commercially available software or analytical techniques is strongly recommended.

5.4.2.5.5 Customer Entrance Protection using Fuses

Customer installations meeting the requirements Section 5.4.2 are permitted to use fuses as Entrance Protection.

Fuse voltage ratings shall match the switchgear voltage rating. Fuses shall be capable of interrupting the maximum fault current level indicated in Section 5.4.2.4.1. Fuse sizes should be selected based on fuse and transformer manufacturer recommendations, with a preference to use the smallest fuse size possible for the application. If applicable, fuses size selection shall meet requirements of the BCEC.

Spare fuses shall be kept on site.

5.4.2.6 Optional Protection

The following protection functions are recommended, but not required.

Protective Function	Description
Voltage Unbalance	Highly recommended to avoid power quality issues associated with single phasing.
Transformer non-electrical protection	Oil temperature, level etc. as equipped by transformer vendor.

Table 4 - Optional Protection

5.4.3 FortisBC Design

FortisBC equipment may be designed as part of the customer Design Build program. A comprehensive design of FortisBC facilities should be completed as part of the formal application. The design for FortisBC facilities shall be done in accordance with FortisBC's Design Guidelines and Design Criteria.

The formal design of FortisBC facilities shall include a single line diagram showing all FortisBC system improvements necessary to meet all looping and operational requirements. This must be developed in cooperation with Regional Engineering.

The plan for infrastructure and the material supply should be done in a timely fashion to ensure FortisBC upgrades are in place when necessary. All proposed non-standard installations should be reviewed and approved prior to construction.

5.4.4 FortisBC Equipment

Use of an Elastimold Model 80 controller for the dedicated VFI is required to allow greater adjustability of trip characteristics.

For installations 4500kVA and less, a maximum of two upstream switcher VFIs between the customer's dedicated VFI and FortisBC substation in the normal configuration will be permitted to allow Cooper EF-450 and EF-600 curve stacking.

For installations over 4500kVA, a maximum of one upstream switcher VFI between the customer's dedicated VFI and FortisBC substation in the normal configuration will be permitted.

5.4.5 Site Plan

The site plan shall show:

a) all the details of the Primary Service installation, civil (including all utilities), drainage, snow; hoarding (if applicable) and electrical plant;
b) location of buildings including the extent of the building footings;

c) location of the Primary Service Vault including counterpoise;
d) location of any surface facilities;
e) routing of primary lines including the Statutory Right-of-Way;
f) road access for FortisBC line trucks to the revenue metering (this shall be designed to accommodate a heavy heavy-duty engine and a swept path analysis accommodating heavy single-unit trucks with trailer);
g) crew access to FortisBC equipment;
h) emergency access/escape routes;
i) minimum operating clearances;
j) grounding provisions; and
k) proposed Primary Service duct layouts and vaults.

5.4.5.1 Service Ducts

Duct line assignments shall be as short and simple as possible to allow for safe and efficient installation and removal of Primary Service cables. Pull Boxes shall be installed in the event calculated pulling tensions or sidewall bearing pressures exceed acceptable limits or at the FortisBC Designer's discretion.

Duct quantities will be dictated by FortisBC standards and design guidelines.

Any FortisBC vaults installed between the nearest VFI and the PCC shall be used only for pulling purposes. No other connections are allowed.

5.4.5.2 Statutory Right-of-Ways

All FortisBC equipment and shared equipment shall be protected by a Statutory-Right-of-Way. The customer shall survey the designated space and execute the agreement which shall be prepared and registered by FortisBC.

5.4.5.3 Other Facilities

Utility and Non-utility facilities shall be designed to meet or exceed all clearances defined within FortisBC standards and CSA C22.3 No 7 Underground Systems.

5.4.5.4 Metering

Metering shall be performed at both primary and secondary voltages.

Secondary meters shall be in a metering cubicle or room with access restricted to FortisBC personnel only. No customer owned equipment shall be installed inside of the primary revenue metering cubicle.

Please refer to the FortisBC Service and Metering Guide for more information.

5.4.5.5 Standby Generation

Standby generation with Open-Transition (i.e., break-before-make) connections are accepted by FortisBC and encouraged in these installations.

Closed transition switches are not acceptable for CAMVE services.

5.4.6 Primary Service Transformer Service Requirements

FortisBC accepts the following customer owned transformer winding configurations:

(a) grounded wye (HV) to grounded wye (LV) : These transformers shall be five-leg cores and have an appropriate impedance to limit fault current; and
(b) delta (HV) to grounded wye (LV).

Transformers shall be installed to ensure easy repair or replacement. Installation should be on ground level and accessible from a roadway unless mitigating engineering factors prevent it.

If this accessibility requirement cannot be met, special provisions shall be put into place to allow for easy replacement. This replacement plan shall be included as part of the formal application, to be reviewed and approved by FortisBC.

5.4.6.1 Service Neutral Connections

The FortisBC system neutral shall be terminated at the customer owned grounded neutral bus with a single point bond. The customer owned neutral shall be insulated and extended to the revenue metering instrument transformer compartment.

5.4.6.2 Transformer Taps and Switches

FortisBC recommends that the customer owned transformers have the following features installed:

a) a loadbreak, internal primary switch to allow for de-energization of the transformer windings;
b) primary tap changers with two steps of 2.5%, above and below rated voltage.

5.4.7 PCC Drawings

There shall be separate access to compartments designated for utility and non-utility workers in the customer owned switchgear. There shall be locking provisions to prevent inadvertent access. All customer owned equipment shall be located in the compartment designated for customer access only.

The PCC shall be designed so that the demarcation point between FortisBC and the customer's plant is at the Medium Voltage terminations in the Supply Service Cable Compartment. FortisBC will own the elbow or t-body termination. The customer will own the bushings and inserts. Please see Section 6.1, and Section 6.2 for detailed drawings. Section 6.3 shows demarcation and shows the typical connection for a 200A Loadbreak elbow.

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

To minimize customer outage time, it is not acceptable to mount equipment inside the switchgear compartments if access to the equipment requires a power outage.

5.4.8 Supply Service Cable Compartment

The Supply Service Cable Compartment shall be restricted to FortisBC access only and reserved solely for mounting service cable terminations. The Supply Service Cable Compartment shall remain free of equipment and conductors not directly related to the Supply Service cables.

FortisBC requires a copper bus for terminating the neutral. A minimum clearance of 50 mm from compartment panels is required to provide clearance for field installation of threaded fasteners.

The service buses/bushings shall have a phasing arrangement of A-B-C, left to right when viewed from the front.

FortisBC requires a minimum of 3m of unobstructed access in front of the Supply Service Cable Compartment to allow safe access for installation and maintenance.

The Primary Service Switchboard or Kiosk drawing shall show the following:

a) fully dimensioned switchboard compartments and details, showing access doors and locking provisions;
b) ground bus layout, equipment grounding pads, and grounding ball studs;
c) Primary Service cable compartment and cable termination;
d) main switch or a breaker switchboard compartment;
e) circuit breaker and protective relaying wiring diagram, as applicable;
f) equipment nameplates; and
g) primary or secondary revenue metering compartment or switchboard compartment.

For further design and installation details, contact a FortisBC Designer.

5.4.9 Outdoor Primary Service Kiosks

FortisBC only accepts dead front switchgear outdoor kiosks. Ducts entering the kiosk shall be sealed to prevent gases and/or vapours from entering the service kiosk.

The kiosk shall have the external cover door shall be equipped with a penta-head bolt locking system and padlocking hasp. For additional details please refer to the FortisBC Service and Metering Guide.

5.4.10 Meter Cabinet

The Meter Cabinet containing the primary metering shall be keyed to the same lock as all building access locks and shall have a minimum of 4.5m clearance for access. Please see the *FortisBC Service and Metering Guide* for more details.

5.4.11 Customer owned Service Entrance Equipment

FortisBC accepts the following customer owned service entrance types and CSA Certified service mains:

a) ganged loadbreak-switch and fuses inside the customer owned Primary Service switchgear;
b) outdoor vacuum switches, interrupters, and breakers; and
c) dead front equipment.

For underground and padmount services surge arrestors shall be installed on the load side of the service switch or the customer owned transformer.

5.5 Joint Operating Order

Once a Formal Application for CAMVE has been received and is deemed acceptable, FortisBC shall create a Joint Operating Order for the connection of the customer owned Medium Voltage equipment. This Joint Operating Order documents critical information such as ownership of the equipment, contacts for all stakeholders, communication processes for obtaining Guarantee of Non-Reclose (GNRs) or customer isolation; and customer owned equipment information (including a single line diagram, technical drawings, and commissioning documentation).

The Joint Operating Order shall be reviewed and renewed on an annual basis. FortisBC reserves the right to request any further information required for the Joint Operating Order as needed.

5.6 Construction of Customer and Supply Authority Owned Facilities

All construction of customer owned facilities shall be done under the supervision and approval of TSBC.

All construction of Supply Authority owned facilities shall be done under the supervision and approval of FortisBC.

All relevant standard, codes and practices shall be met in all cases.

5.6.1 Scope of Supply

5.6.1.1 FortisBC Scope of supply for CAMVE connections

FortisBC shall supply and install the following for CAMVE connections:

a) Primary Service Connection cables (FortisBC-owned, pulled in FortisBC-owned service ducts);
b) Primary Service Connection cable support clamps;

c) duct caps/seals;
d) padlocks to secure utility-restricted equipment;
e) equipment identification and safety decals;
f) Primary Service Connection cables installed the utility Supply Voltage cable compartment of the customer owned Primary Service Switchboard as the PCC;
g) grounding, bonding and neutral connections for FortisBC equipment (unless other grounding provisions have been arranged); and
h) switching facilities to manage load redundancy or support.

FortisBC shall supply switchgear primary revenue metering transformers for installation by the Customer's Electrical Contractor for primary underground services.

FortisBC shall supply and install all secondary revenue metering for services that do not require instrument metering. Instrument metered services FortisBC shall supply the CT's and VT's for the Customer's Electrical Contractor to install.

All revenue metering equipment and necessary conduits shall be installed by the Customer's Electrical Contractor. FortisBC shall supply and install all control and interconnection wiring for the revenue metering.

5.6.1.2 Customer Scope of Supply for CAMVE connections

All service ducts (conduits), Pull Boxes and pull-pits on private property shall be installed by the customer in accordance with FortisBC Specification for Installation of Underground Conduit Systems. and TSBC regulations.

The customer shall supply and install the following, as applicable:

a) a concrete pad for the Primary Service Kiosk with duct window and conduit stubs located to align with the utility service cable compartment bus bars or service bushings;
b) all customer owned cable, ducts, conduits and fittings on private property;
c) all Primary Service ducts located on private property;
d) a Primary Service device serving as the demarcation point, with bushings compliant with IEEE386 *Separable Insulated Connector Systems for Power Distribution Systems Rated 2.5 kV through 35 kV* and FortisBC equipment specifications as per FortisBC standards; and
e) appropriately sized surge arrestors
f) Completion of the termination of the FortisBC supplied elbow/T-body to the customer's bushing, under the supervision of FortisBC Operations. See Section 5.7.4 for more details.

It is the customer's responsibility to ensure the primary bushings are an appropriate match for FortisBC's supplied termination. Any manufacturer mismatches are the responsibility of the Customer's Electrical Contractor to resolve.

5.6.1.2.1 Service Ducts

All service ducts/conduits on private property shall be installed by the Customer's Electrical Contractor in accordance with the FortisBC Specification for Installation of Underground Conduit Systems and CSA C22.3 No 7 Underground Systems.

FortisBC-owned service cable runs on private property shall be kept to a minimum to ensure easy replacement in the event of cable damage/failure.

Additional markers for the location of the cables may be required for any portion of the underground service duct run on private property with a high risk of future potential damage from dig-ins. These are installed at the discretion of the FortisBC Designer.

5.6.1.2.2 Primary Service Ducts

CSA-Certified PVC type DB2 ducts, encased in concrete are required to be installed as per FortisBC's Specifications for the Installation of Conduit Systems.

FortisBC personnel use standard pulling equipment and mandrels which are best suited for the unrestricted diameter of the conduit. Conduits shall be installed using factory standard bends with a minimum 914 mm radius for 4" (100 mm) diameter ducts. All duct end fittings shall be sealed with duct caps.

5.6.2 Inspections

Inspection of any facilities that will be owned by FortisBC shall be inspected by FortisBC Operations. Any installations that have been backfilled, or otherwise un-inspectable will not be accepted.

These inspections shall verify:

a) trench alignment and depth;
b) conduit configuration, integrity and arrangement;
c) concrete encasement as necessary;
d) conduit proofing with mandrel;
e) pull tape installation;
f) grounding connections; and
g) surface and subsurface equipment location and depth of installation.

All inspection requirements shall be met prior to site energization.

5.7 Commissioning and Energization

Prior to service energization, the customer will ensure the following:

a) the Protection Coordination Report (see Section 5.7.1) has been submitted to FortisBC and accepted;
b) equipment and site Commissioning Drawings/Reports have been submitted to FortisBC and accepted;
c) inspection Reports have been submitted to FortisBC; and
d) site servicing requirements are met.

This information shall be provided to the FortisBC Designer. Once that information has been received, please allow ten business days for review prior to energization.

5.7.1 Protection Coordination and Commissioning Reports

The Protection Coordination Report, sealed by a Professional Engineer, shall include the following:

a) final as tested TCCs; and
b) final as tested relay setting file (if applicable).

The Final Protection Commissioning Report, sealed by a Professional Engineer, including the following:

a) relay commissioning documentation (not applicable for fused Entrance Protection);
b) CT primary injection test results (not applicable for fused Entrance Protection); and
c) circuit Breaker/VFI test results (not applicable for fused Entrance Protection).

5.7.1.1 Primary and Secondary Current Injection Tests

Primary and/or secondary current injection tests must be performed as part of the commissioning process. In the case only secondary injection tests are performed at site, results for primary injection testing of the CTs by the switchboard manufacturer must be provided with commissioning documentation.

5.7.2 Equipment and Site Commissioning Drawings/Reports

Equipment and site commissioning drawings sealed by a Professional Engineer including the following:

- transformer production and commissioning test report for customer-owned transformers, including an oil analysis report, if applicable;
- HV cable test report for Service Connections involving customer owned cables and;
- “As Constructed” engineering record drawings for all documents requested in the Formal Application;

5.7.3 Inspection Reports

The following inspection reports are required from either a TSBC Safety Officer or the Class A Electrical Field Safety Representative named in the customer's Annual Operating Permit:

a) final inspection certificate from the site inspection AHJ. If a local authority waives the final inspection, FortisBC shall accept a declaration per the permit process;
b) contractor declaration per the permit process;
c) a copy of the TSBC certificate of final inspection after completing installation, which certifies all electrical equipment was installed in accordance with applicable codes and local bylaws.
d) a copy of Annual Operating Permit for Medium Voltage service, including the name and contact information of the field service representative for the Primary Service installation and customer.

All FortisBC inspections must be satisfactorily completed, and all deficiencies remedied prior to energization.

5.7.4 Service Connection

FortisBC will provide a Supply Service cable with a completed elbow or T-body termination. The customer's Class A FSR shall connect that termination to the Point of Common Coupling (customer owned medium voltage bushing) under FortisBC Operations supervision. The work shall be done following applicable WorksafeBC and FortisBC's work methods and lockout procedures.

5.7.5 Site Metering

The primary metering shall be used as a means of establishing the customer and tracking overall usage of the site. This customer shall be the same as the signatory of the secondary metering agreement.

Secondary metering shall be used for billing purposes.

5.8 Maintenance and Testing

The customer is responsible for regular maintenance, testing and operation of the Primary Service equipment and Entrance Protection schemes in accordance with manufacturers' recommendations and CSA Z463 – Maintenance Electrical Equipment. This includes regular inspection of equipment for visible defects and diagnostic alarms. Functional tests, including trip testing of the entrance Circuit Breaker/VFI, shall be performed as per industry standard and manufacturers recommendations.

FortisBC reserves the right to request the customer test their equipment and perform necessary maintenance. Maintenance that requires outages shall be coordinated with FortisBC as per the Joint Operating Order.

6 Appendix

6.1 Customer Owned MV Switchgear protected with Relays and Circuit Breakers

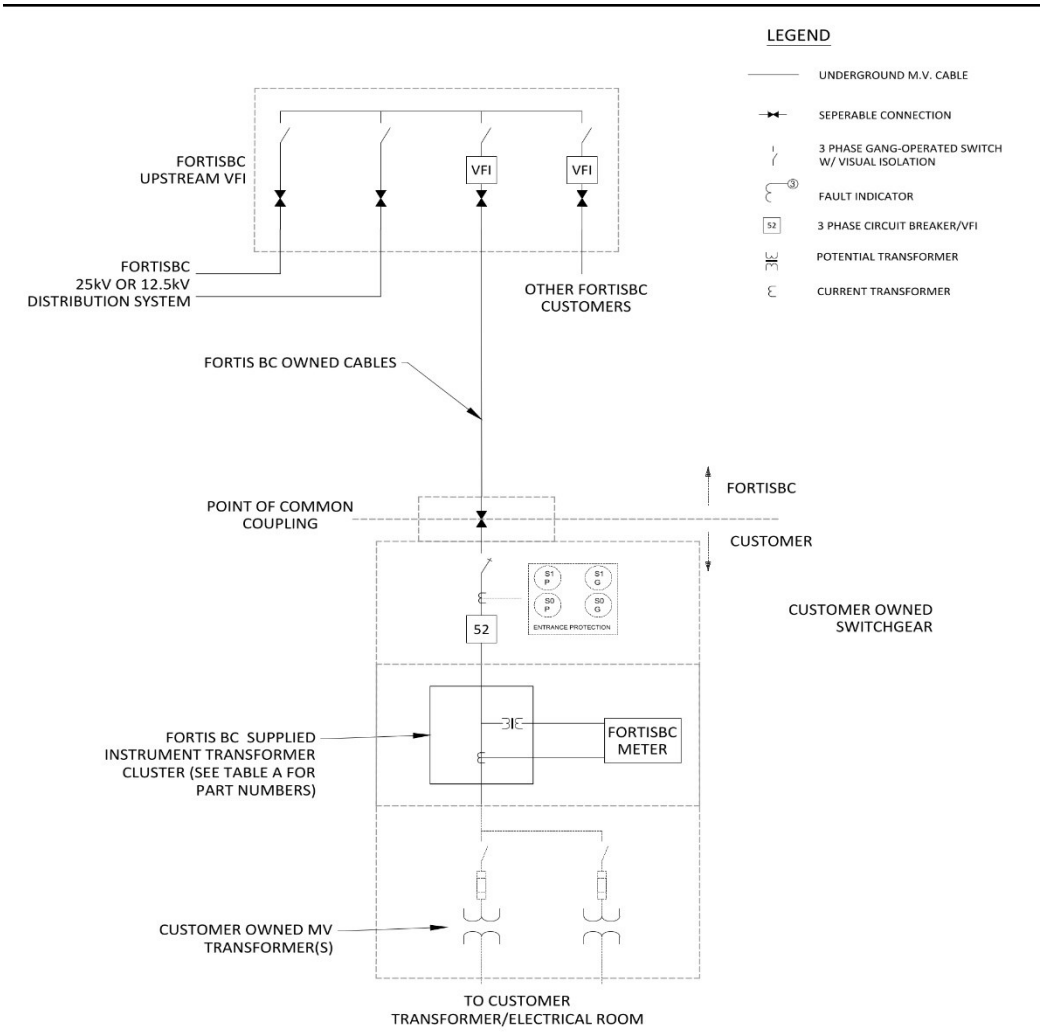

TABLE A		
PART #	VT RATIO	CT RATIO
6087101	7200/14400:120V	100:5A
6087103	7200/14400:120V	300:5A

NOTE:
1. CUSTOMER SWITCHGEAR TO BE RATED FOR BOTH 12.5kV AND 25kV.

Figure 2 Customer Owned MV Switchgear Protected with Relays and Circuits

6.2 Customer owned Switchgear FortisBC Cable Entrance Detail

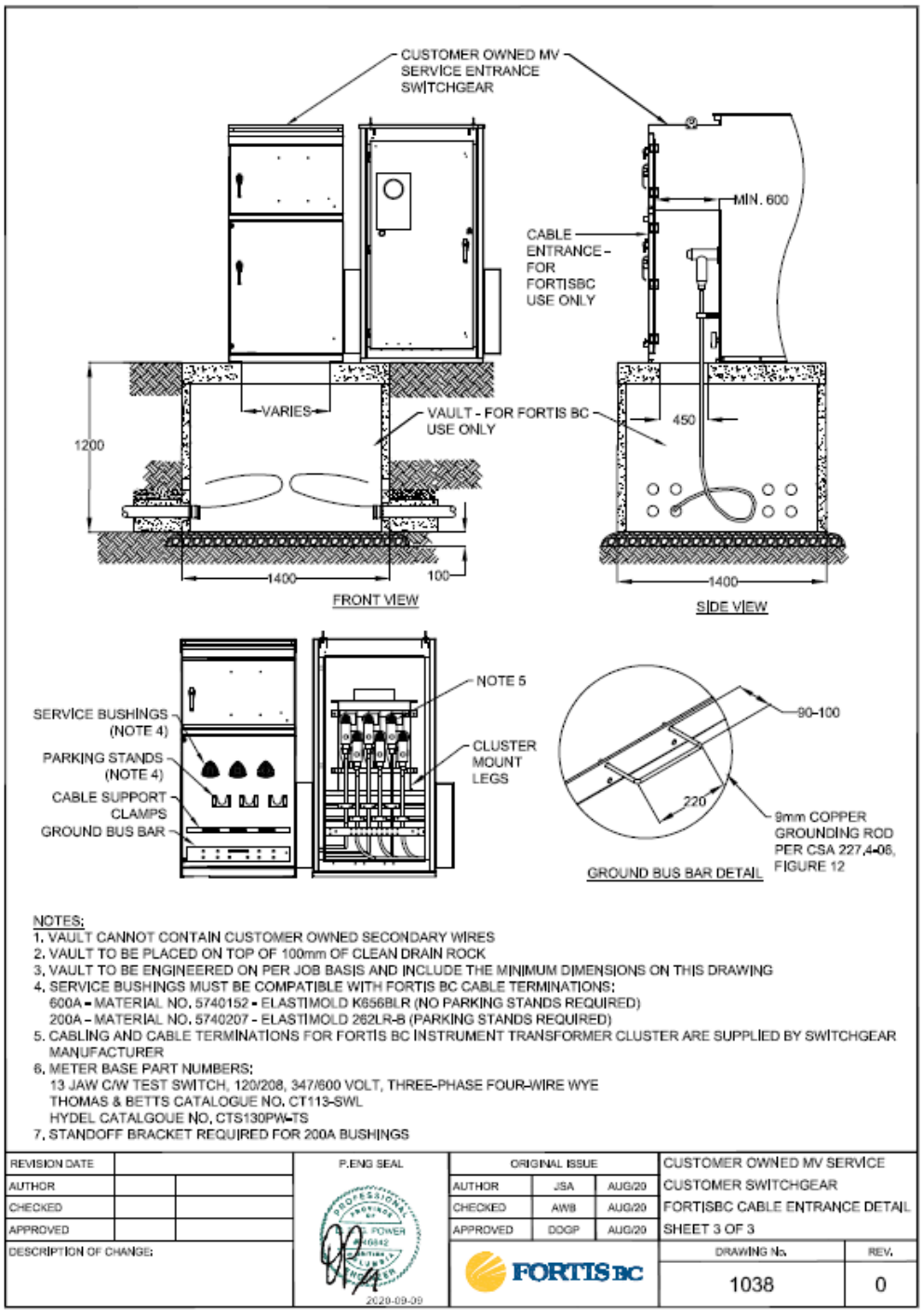

Figure 3 Customer Owned MV customer Switchgear Cable Entrance Detail.

6.3 CAMVE Demarcation Detail

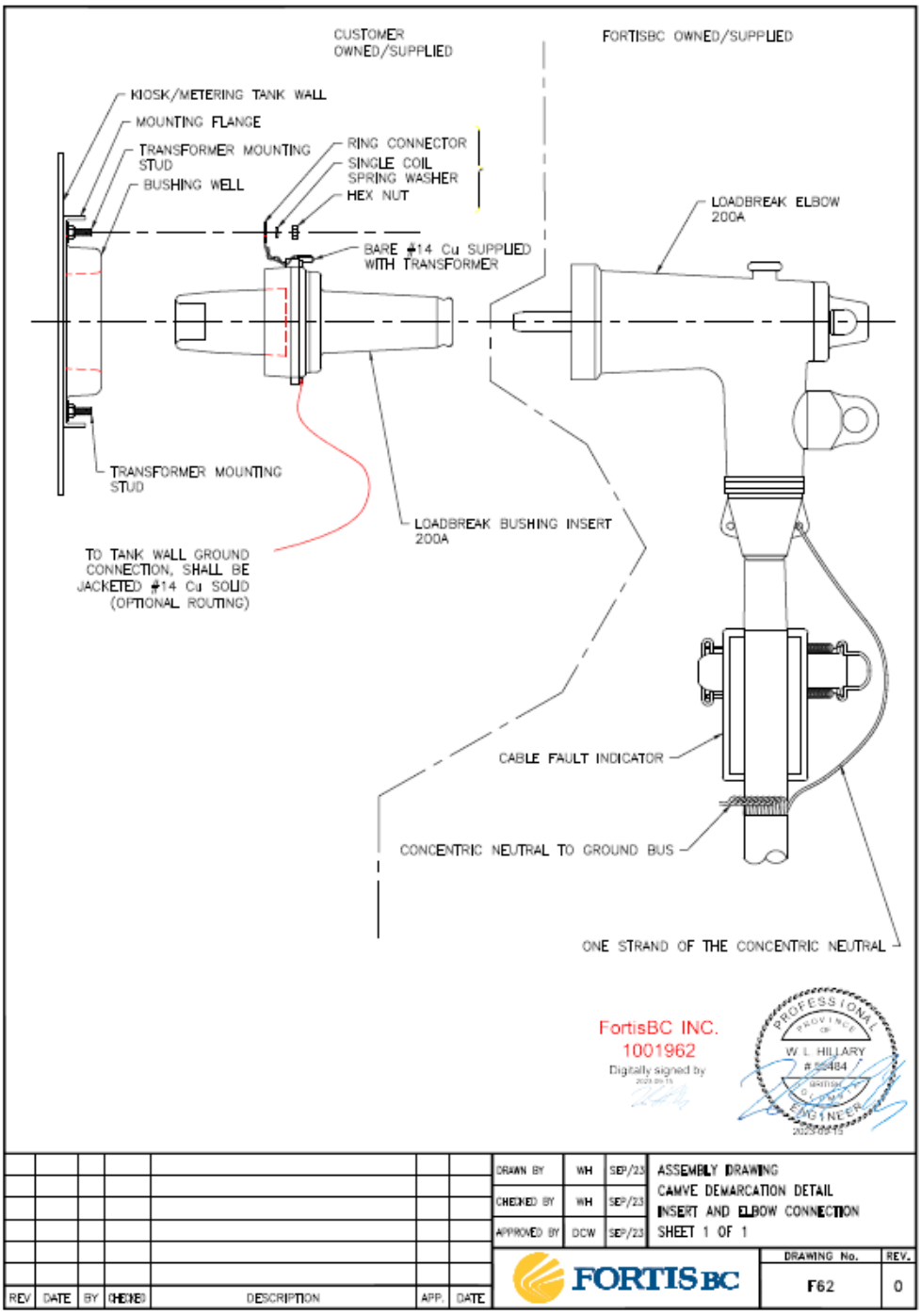

Figure 4 CAMVE Demarcation Detail

6.4 Example TCC

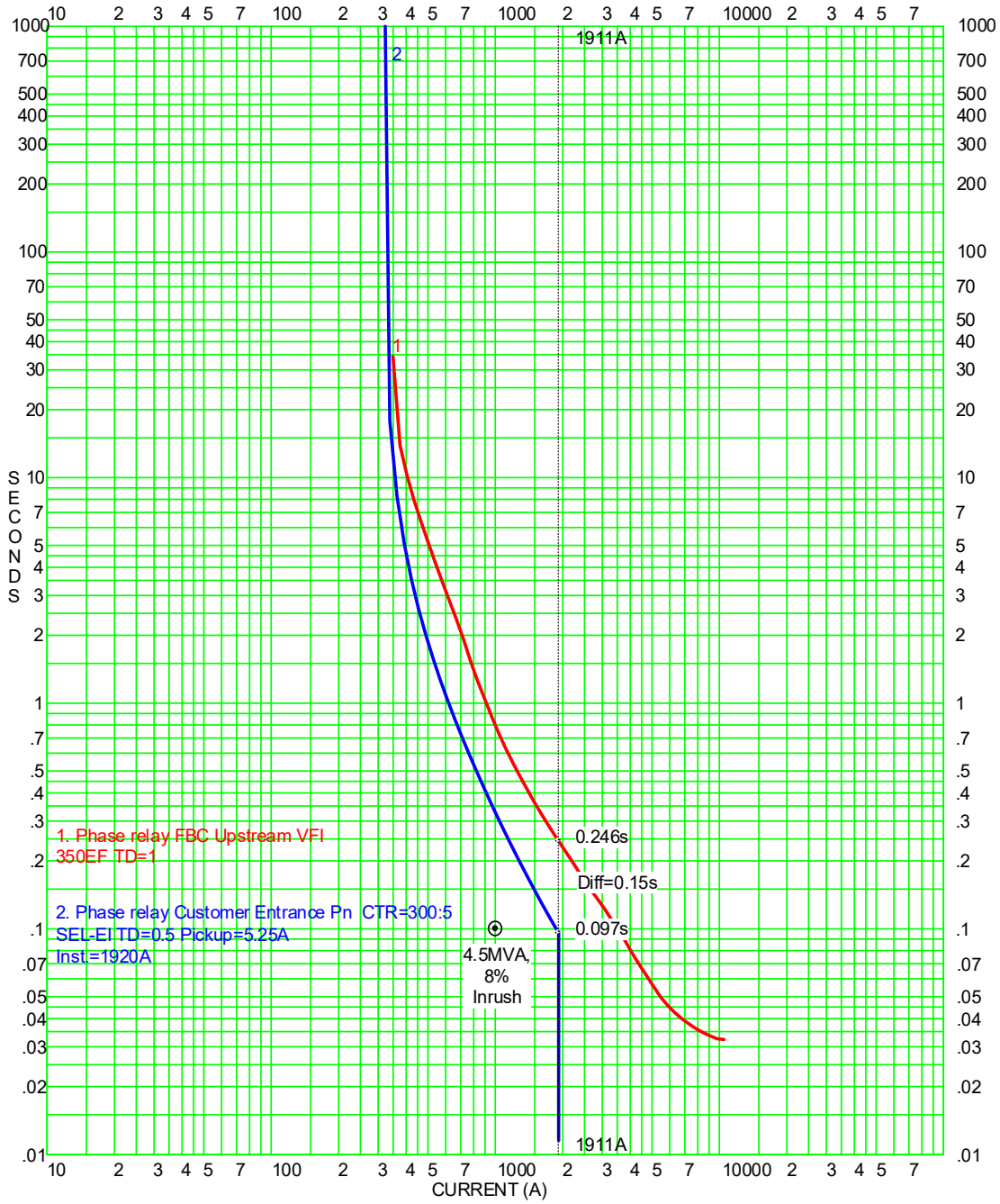

Figure 5 Sample TCC Curve