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REVISIONS: UPDATED LEGAL ACKNOWLEDGEMENT FORM. FD MAR '16

DESIGNED J. AGNOLIN	RECOMMENDED  F. DENNERT	ACCEPTED  G. REIMER	ENGINEER OF RECORD 	NOTICE FROM THE EXECUTIVE VICE PRESIDENT TRANSMISSION AND DISTRIBUTION AND CUSTOMER SERVICE		
DISTRIBUTION STANDARDS 		ISSUED: MAR 2016 REPLACES: MAY 2004 ORIGINALLY ISSUED: NOV 1980				PAGE 1 OF 2

Scope

This manual is one of a series containing standards for construction of the BC Hydro electrical distribution plant within the service area of BC Hydro. A new distribution plant shall be designed, constructed, owned, operated, maintained and repaired to these standards.

Purpose of Standards

BC Hydro objectives require standardization to:

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

Responsibility

The Distribution Standards Department prepares these standards and verifies that specified plant and procedures will perform adequately under all normally expected conditions encountered throughout the province of British Columbia. These standards are approved by Professional Engineers. It is the responsibility of BC Hydro Managers to ensure that the standards are followed unless abnormal conditions are encountered that require variations. These variations should be kept to a minimum and their performance shall be the responsibility of the Professional of Record in charge of the project, who will record and seal the variation based on satisfactory qualifications and experience to do so. As per the latest revision of the BC Hydro Distribution Owner's Engineer Guide, these variations must be accepted by BC Hydro's Owner's Engineer.

Use of Stock Materials

The electrical distribution plant covered by these standards is built using stock materials approved by a Professional Engineer as required by law. The use of non-stock materials for special and unusual situations must be approved by Distribution Standards or the BC Hydro Engineer responsible for the project.

Revisions to Manual

These standards are revised from time to time to improve the safety, performance, workability, cost effectiveness or appearance of the plant. The existing plant built to previous standards need not be updated unless so specifically advised by BC Hydro. When maintenance or other work, such as voltage conversion or conductor change is being done, updating plant to current standards is encouraged.

Mailing Addresses

The manual has been issued to a corporation or firm rather than to an individual. The corporation or firm is responsible for the safekeeping of the manual, and for keeping it current. Changes of address or in number of copies required must be reported promptly.

Suggestions for changes in the manual, or required changes of address may be made on the pre-addressed comment sheet included in the Manual and with each issue of revision.

REVISIONS: UPDATED LEGAL ACKNOWLEDGEMENT FORM. FD MAR '16

DESIGNED J. AGNOLIN	RECOMMENDED  F. DENNERT	ACCEPTED  S. REIMER	ENGINEER OF RECORD  F. U. DENNERT PROFESSIONAL ENGINEER BRITISH COLUMBIA	NOTICE FROM THE EXECUTIVE VICE PRESIDENT TRANSMISSION AND DISTRIBUTION AND CUSTOMER SERVICE		
DISTRIBUTION STANDARDS BC Hydro		ISSUED: MAR 2016 REPLACES: MAY 2004 ORIGINALLY ISSUED: NOV 1980		PAGE 2 OF 2	ES43/53/54/55/65 A1-01.02	R 4

Application

This standard describes BC Hydro requirements for customer-owned surface-mounted single-phase 120/240 V single 400 A and 600 A secondary voltage underground services for small residential, commercial, and industrial customers. These services have CT-based revenue meter and integral service main breaker and may be installed indoors inside a shed or closet, or outside on a house wall or acceptable permanent support structure.

Revision Notes

Replaced table of cable clamp sizes with reference to ES53 S1-01. Clarified note 6a with $\frac{3}{4}$ " diameter duct. Table 3 wireway minimum height reduced from 1400 mm to 1200 mm. Changes are marked by green vertical revision lines in the left margin. This revision released concurrently with Standards and Equipment Advisory 2022-023 R1 Information Bulletin: *Release of ES54 S0-04 and S1 Standards for 120/240 V Single-Phase Secondary Services up to 600 A*.

References

BC Hydro Distribution Standards

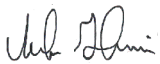
ES53 S1-01	Secondary Services Single-Phase up to 600 A 120/240 V Wiring and Revenue Metering Connections
ES54 S0-02	Services General Notes
ES54 S0-04	Services General Notes Secondary Services
ES54 S0-05	Services General Notes Service Ducts and Trenches
ES54 S1-01	Secondary Single-Phase Services 200 A Single and 400 A Multiple Self-Contained Meter Installation

Other BC Hydro Documents

DI S10-1	Distribution Instruction, Electric Service Connections – General
DI S10-4	Distribution Instruction, Electric Service Connections – Voltages
Secondary Metering	Requirements for Secondary Voltage Revenue Metering (750 V and less)

External Documents

BCEC	Canadian Electrical Code, Part I (CSA C22.1) adopted for BC and endorsed by Technical Safety BC (TSBC)
TSBC D-EI 2017-01	Directive: Exemptions to public utilities
TSBC IB-EL 2017-04	Information Bulletin: Electrical Safety Regulation application to public utilities

Designed: M. Kelvin, P. Eng			Secondary Single-Phase Services 400 A and 600 A CT-Based Meter Installation	
Checked: M. Kelvin, P. Eng				
Reviewed: M. Stevens, P. Eng			DISTRIBUTION STANDARDS BC Hydro	ES54 S1-03 R1
Approved: H. Giesbrecht, P. Eng		Issued: 2023-06-30 Effective: 2023-07-31		

Notes

1. General

- a. Residential single 400 A and 600 A and multiple 400 A 120/240 V services may be installed inside a detached power shed, an outdoor pad-mounted power kiosk, an external closet attached to a dwelling, or on an external building wall. BC Hydro personnel shall have unrestricted access directly from the outside.
- b. Commercial and industrial 400 A and 600 A 120/240 V service equipment located inside a customer building is acceptable as shown in Figure 1.



Figure 1 – Acceptable commercial meter closet inside building

- c. Customer service, bonding, and grounding conductors shall be installed and terminated on the load side before BC Hydro installs utility supply cables and seals the meter socket for BC Hydro access only.
- d. Civil work and grounding installations are the responsibility of the customer. See ES54 S0-05 for service duct and trench requirements.
- e. BC Hydro accepts both grounding options of meter socket and customer service ground in compliance with BCEC Rule 10-210.
- f. 400 A and 600 A 120/240 V services require BC Hydro to install larger pad-mounted transformers with higher available fault levels (above 10 kA). All new construction and upgraded 400 A and 600 A customer-owned service breaker panels shall have a minimum 22 kA interrupting capacity.

2. Service in Duct

- a. Underground service duct should be installed outside the foundation walls and run on the surface of the exterior building walls. Service duct may be installed within the foundation and building wall if encased in concrete.
- b. Service ducts inside building walls shall be encased in concrete as a fire barrier. BC Hydro does not provide overcurrent protection for supply service cables. This requirement is consistent with BCEC Rule 6-208 for customer-owned service conductors.

3. Service Entrance

- a. Table 1 shows acceptable enclosure and service assembly options for 400 A and 600 A services.
- b. Minimum dimensions shown in figures are required for adequate working space for BC Hydro personnel. The customer may use larger enclosures if necessary.
- c. Table 2 shows minimum knockout and tunnel-type cable lug sizes for 400 A and 600 A services.

- d. BC Hydro will supply and install the cable clamps required for service cables. The cable clamps shall be installed in customer-supplied 1½" x 1½" C-channels mounted on a slotted adjustable angle bracket, suitable for facing either outward or upward. Slotted angles, as shown in Figures 11 and 13, shall provide back-and-forth adjustment of the C-channel within 100 mm of the front or back of the enclosure. BC Hydro shall supply all threaded hardware and cable clamps required for supporting BC Hydro service cables. See ES53 S1-01 for more on BC Hydro-supplied cable clamps.

Table 1 – Minimum enclosure options for 400 A and 600 A 120/240 V services

Option	Figure	Service Size (A)	Breaker	CT Provision	Ducts or Full Wireway	Prefabricated or Field Assembled
1	7	400	Yes	Integral	Ducts	Prefabricated, Hydel
2	8	400	Yes	Meter socket	L-box, full wireway	Field assembled
3	9	400	Yes	Meter socket	Ducts, compact wireway	Field assembled
4	10	400	Yes	Compartment	Ducts, compact wireway	Field assembled
5	11	Up to 600	Yes	Separate enclosure	Full wireway	Prefabricated
6	12	Up to 600	Yes	Field installed	L-box, full wireway	Field assembled

Table 2 – Minimum KO size and line side lugs for 400 A and 600 A 120/240 V services

Service Size	Minimum KO and Duct Size	Minimum Line Side Cable Lug Range
Up to 400 A	3"	#4/0 500 kcmil Cu/Al
Up to 600 A	2 x 3"	#4/0 500 kcmil Cu/Al, two lugs per phase

4. Construction Details for 400 A and 600 A Services

- a. A circuit breaker only as customer service main is acceptable to BC Hydro. A fused loadbreak switch is not permitted since the customer access requirement for fuse replacement precludes effective sealing of unmetered conductors and buses. See Figures 2 and 3.



Figure 2 – Unacceptable loadbreak switch



Figure 3 – Acceptable service main breaker

- b. BC Hydro no longer terminates utility supply cables directly onto a customer-owned service main due to liability and restricted access. The customer shall provide a separate utility service cable compartment and certified splitter for terminating utility supply cables and customer-owned cables. An example of a certified splitter is shown in Figures 4 and 6.

- c. Customer service splitter busbars shall extend into the utility cable compartment and be fitted with line-side tunnel-type lugs for terminating BC Hydro supply cables. BC Hydro will accept staggering of phase cables over neutral, as shown in Figures 4 and 5.
- d. See Figure 6 for minimum dimensions and details on cable lug and busbar clearances, busbar staggering, and splitter portion insulator spacers. The dimensions shown in Figure 6 are BC Hydro requirements for working space. Clearances from conductive components to the metal enclosure shall comply with CSA 22.2 standards.

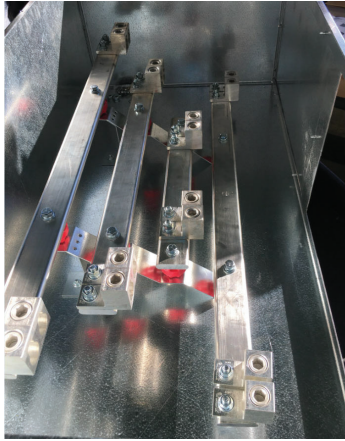


Figure 4 – Splitter bus layout and spacing

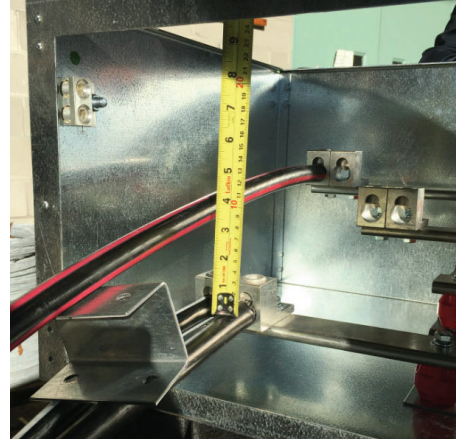


Figure 5 – Phase cable staggered over neutral

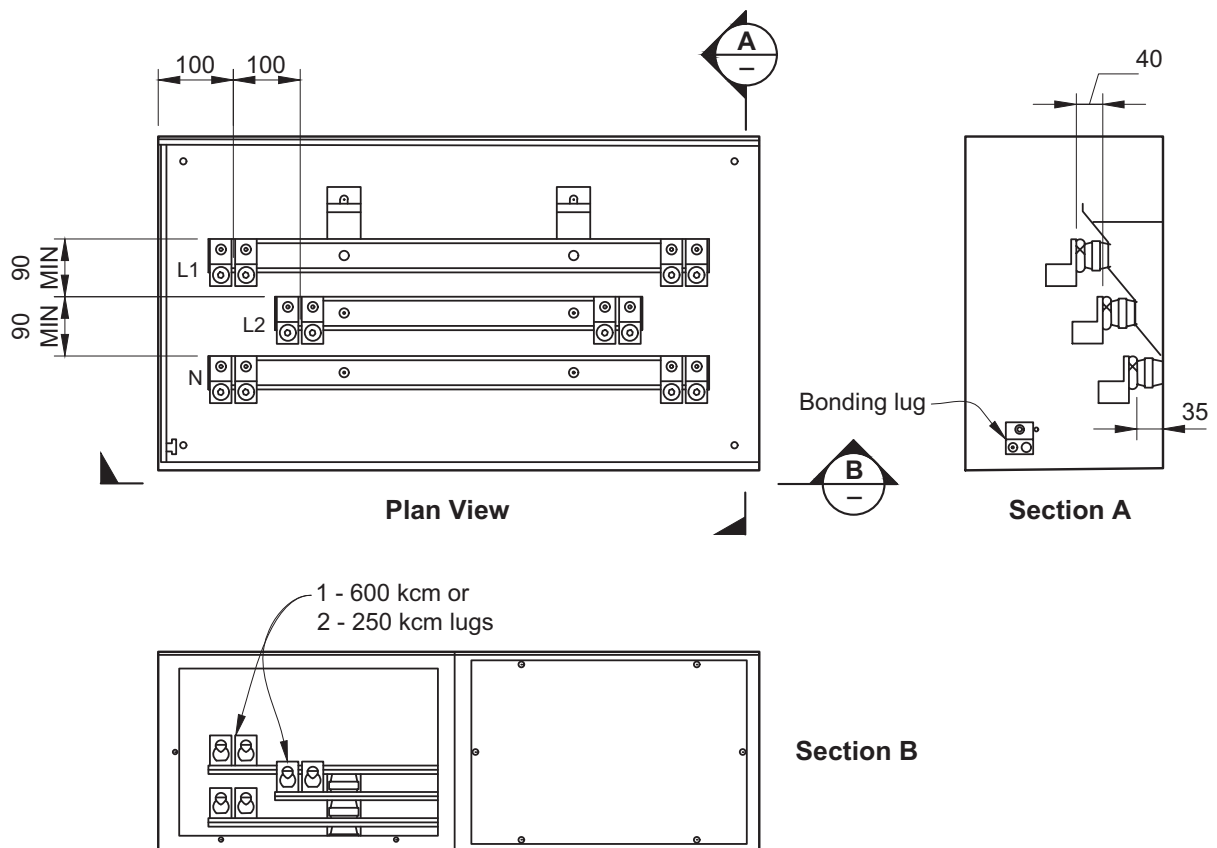


Figure 6 – Certified splitter up to 600 A

5. 400 A 120/240 V Service Assemblies

- a. Hydrel offers a fully integrated 400 A 120/240 V customer service assembly with an integral utility cable compartment, splitter, 400 A service main, 400:5 A CT block, and 5 A revenue meter as shown in Figure 7. The entire Hydrel enclosure is sealed for BC Hydro access only. The customer can access the service main breaker handle through a lockable hinged breaker cover as shown in Figure 7.

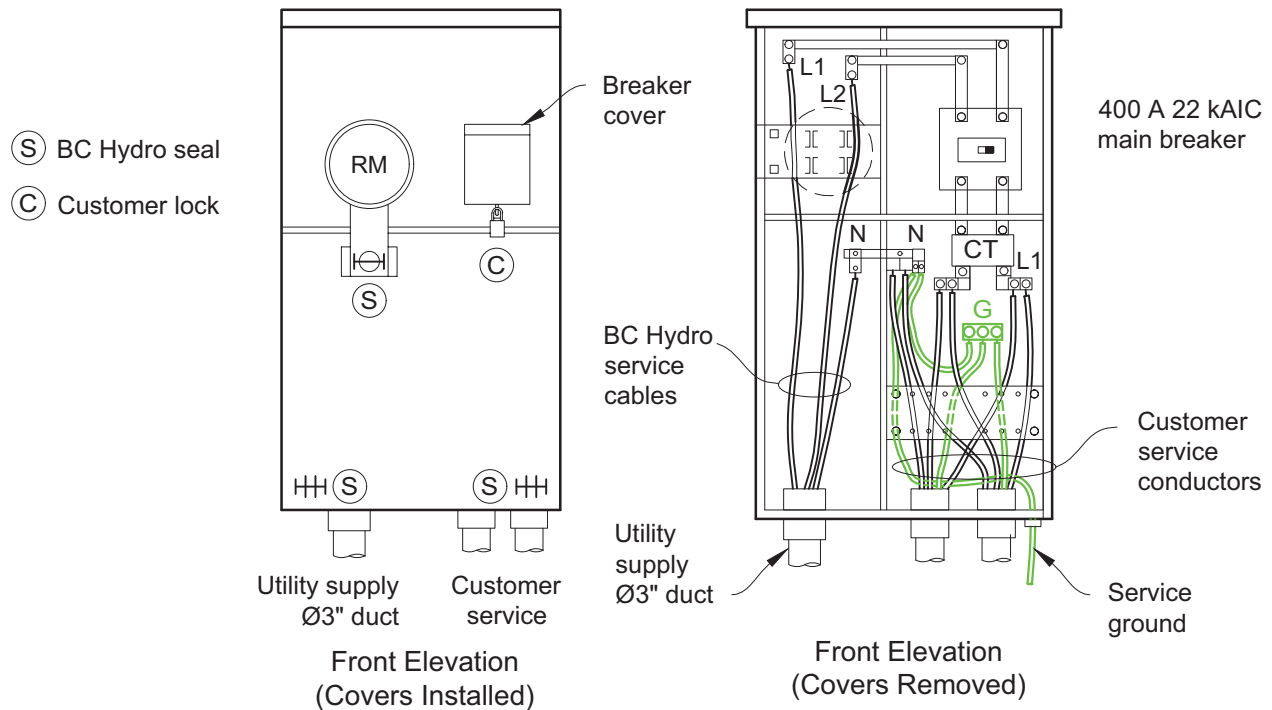


Figure 7 – Hydrel 400 A integral with breaker and CT

- b. Microelectric and Hydrel self-contained 400 A meter sockets with 400:5 A integral CT and test blocks require the installation of a 400 A service breaker ahead of the meter socket for safety isolation. See Figures 8, 9, and 10.

- c. Figure 8 shows a field-assembled installation and construction details for a full-size indoor-type service assembly with a prefabricated L-box having an integral utility cable compartment and a splitter. The L-box, including utility cable compartment and a splitter, is sealed with sealing studs for BC Hydro access only. The customer service breaker is installed inside a separate enclosure and is sealed for BC Hydro access only. The customer can access the service main breaker handle without breaking any seals.

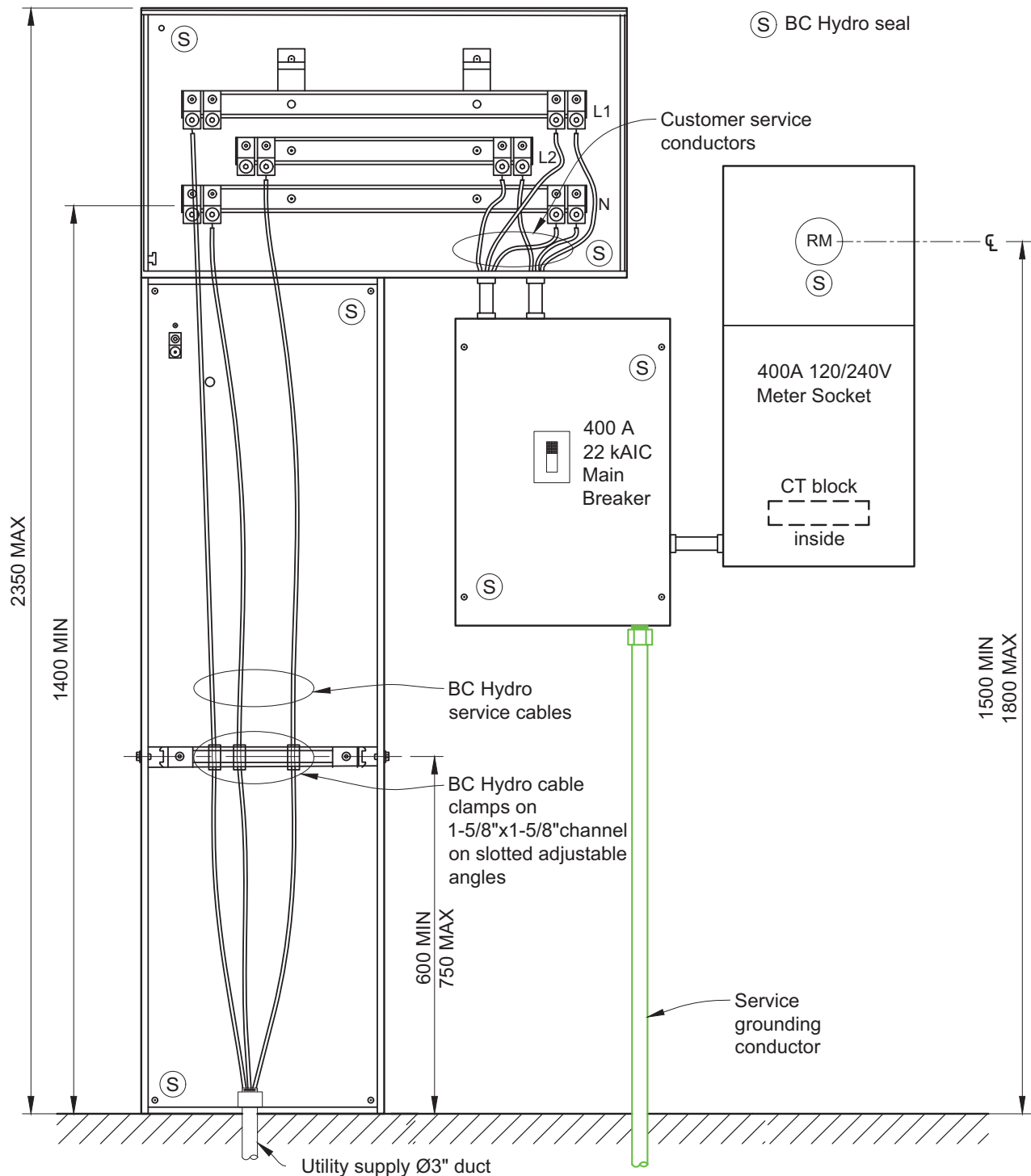


Figure 8 – 400 A service assembly using L-box

- d. Figure 9 shows construction details for a compact enclosure service assembly with an integral service breaker suitable for outdoor-type surface mounting. An example of such an installation is shown in Figure 3. The service enclosure is locked for BC Hydro access only. The customer can access the service main breaker handle through a lockable hinged access hatch as shown in Figure 9.

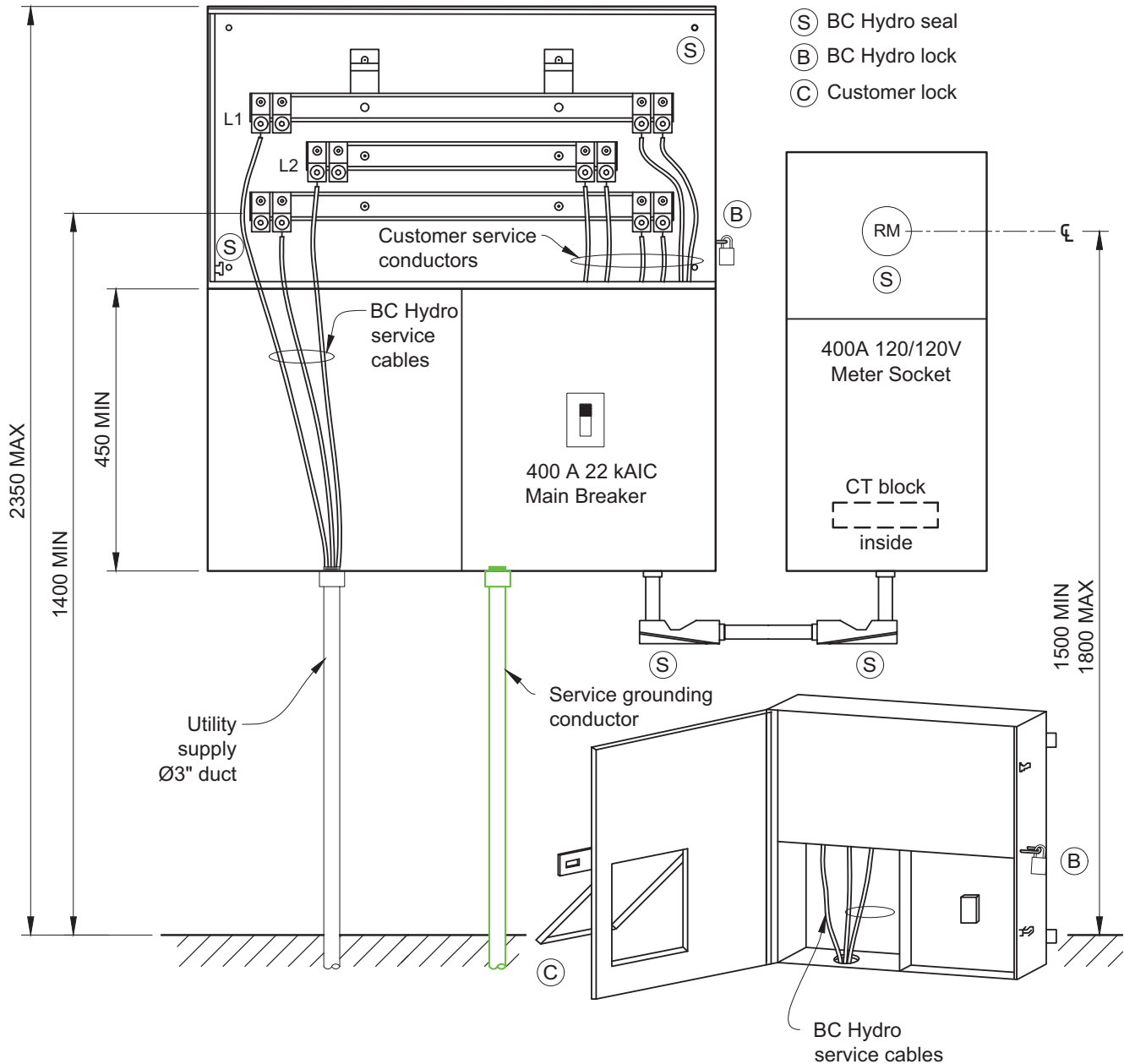


Figure 9 – 400 A service assembly using 3R outdoor-type enclosure

- e. BC Hydro will accept a certified splitter mounted vertically (see Figure 10). Vertical splitter busbars shall be spaced 100 mm apart to the centerline of the busbar or cable lugs. BC Hydro requires a utility wireway a minimum 450 mm below the splitter to train and terminate service cables.

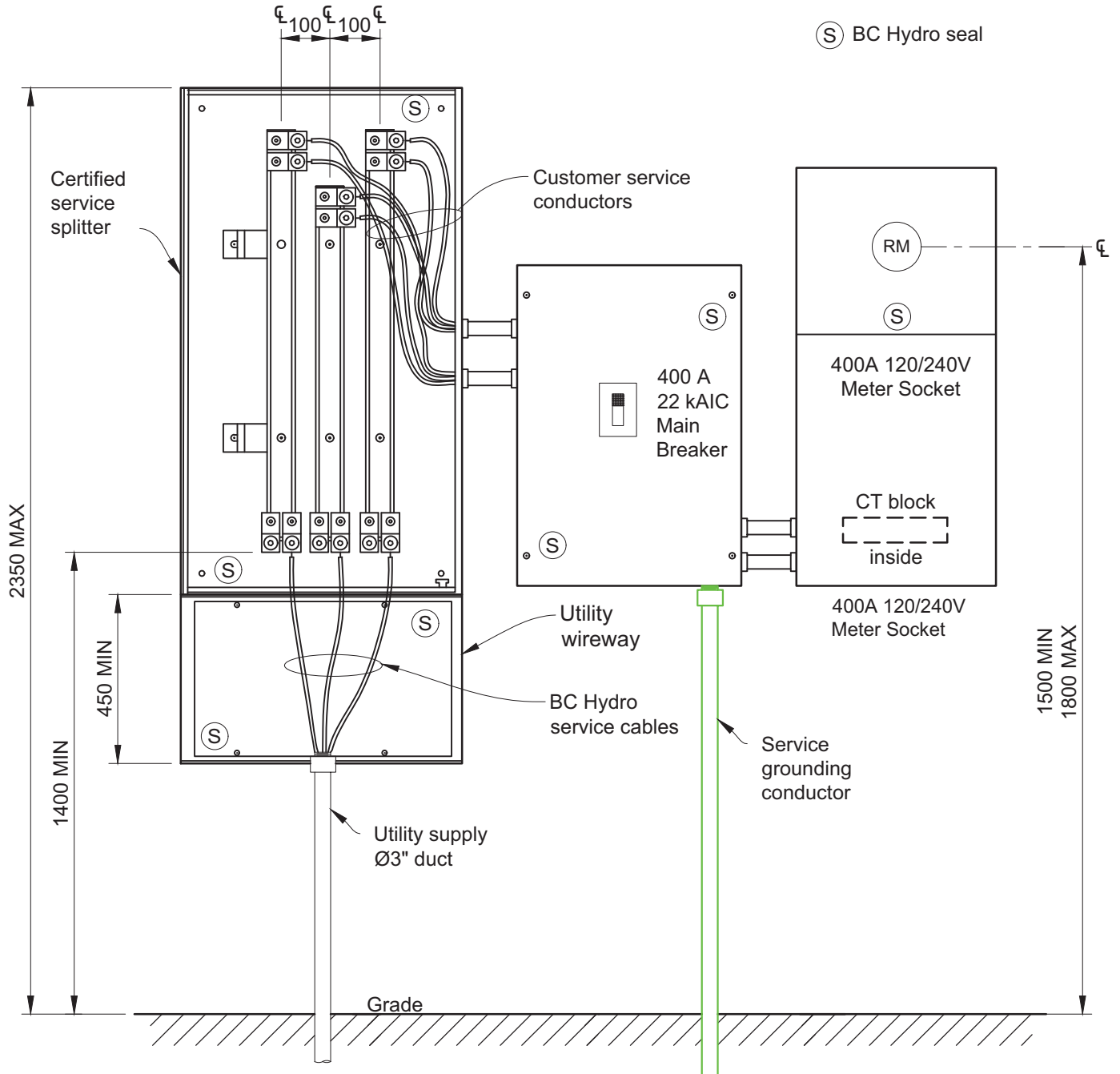


Figure 10 – Typical indoor-type vertically mounted service splitter

6. 600 A 120/240 V Prefabricated Service Assemblies

- a. The majority of 600 A 120/240 V customer service assemblies are installed as prefabricated enclosures comprising an integral utility cable compartment, splitter, service main, and a BC Hydro revenue metering compartment below the service main.

For some installations, the customer could install a field-assembled service assembly comprising a separate utility cable compartment, splitter, service main enclosure, and revenue metering cabinet. Such installations require the customer to install another load-side splitter for connecting several customer feeder cables.

Both configurations (prefabricated and field-assembled) require the customer to install a separate 100 A 120/240 V meter socket for a BC Hydro 5 A secondary revenue meter fed from the revenue metering compartment or a box via $\frac{3}{4}$ " (18 mm) diameter duct.

- b. Figure 11 shows typical construction of an indoor-type prefabricated 600 A 120/240 V service, which may also be used for a 400 A customer service assembly. See Table 3 for minimum dimensions.

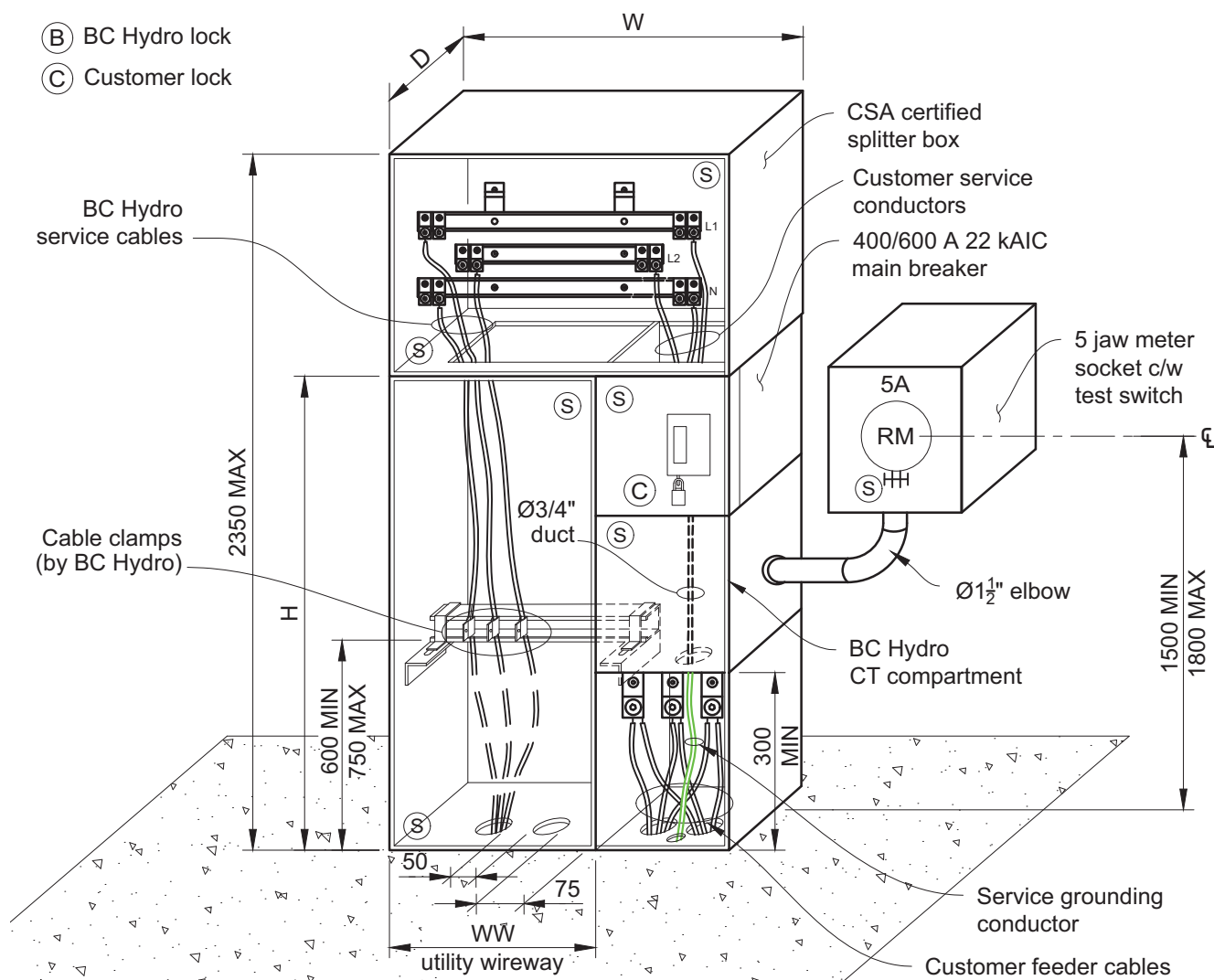


Figure 11 – Prefabricated integral assembly up to 600 A, bottom entry

- c. Figure 12 shows typical construction of a field-assembled 600 A 120/240 V service indoor-type customer-owned service assembly. The customer shall install a separate revenue metering enclosure and separate 5 A revenue meter socket for such installations. See the Secondary Metering guide for further requirements. BC Hydro will not accept an outdoor-type field-assembled 600 A service as shown in Figure 12. See ES54 S1-04 for outdoor-type installations (kiosks).

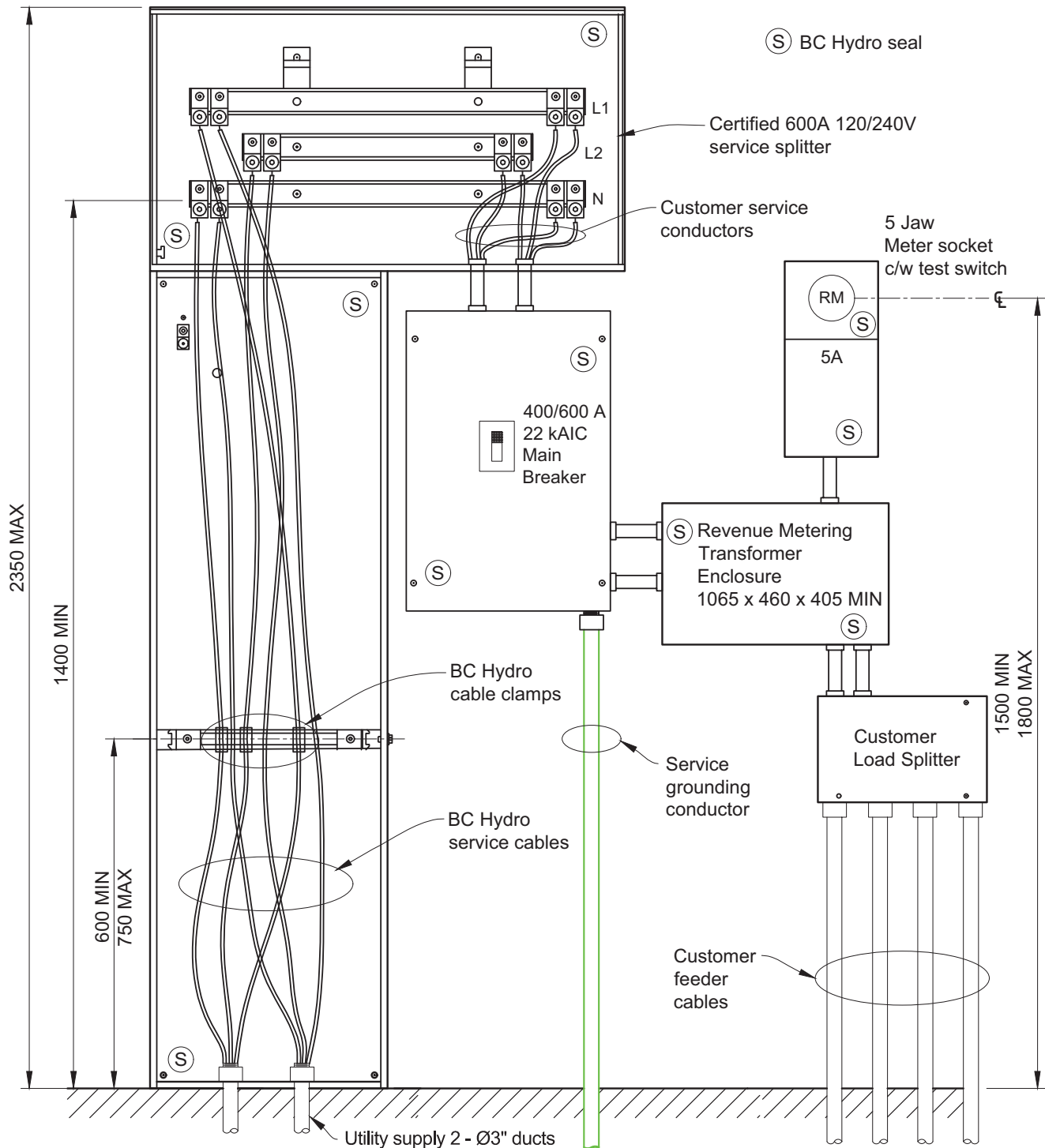


Figure 12 – 600 A field assembled indoor-type service

- d. Figure 13 shows prefabricated customer-owned service entrance equipment suitable for alternative BC Hydro service cable entry locations (top, rear, and side). Table 3 provides the minimum size of pull boxes and wireways.

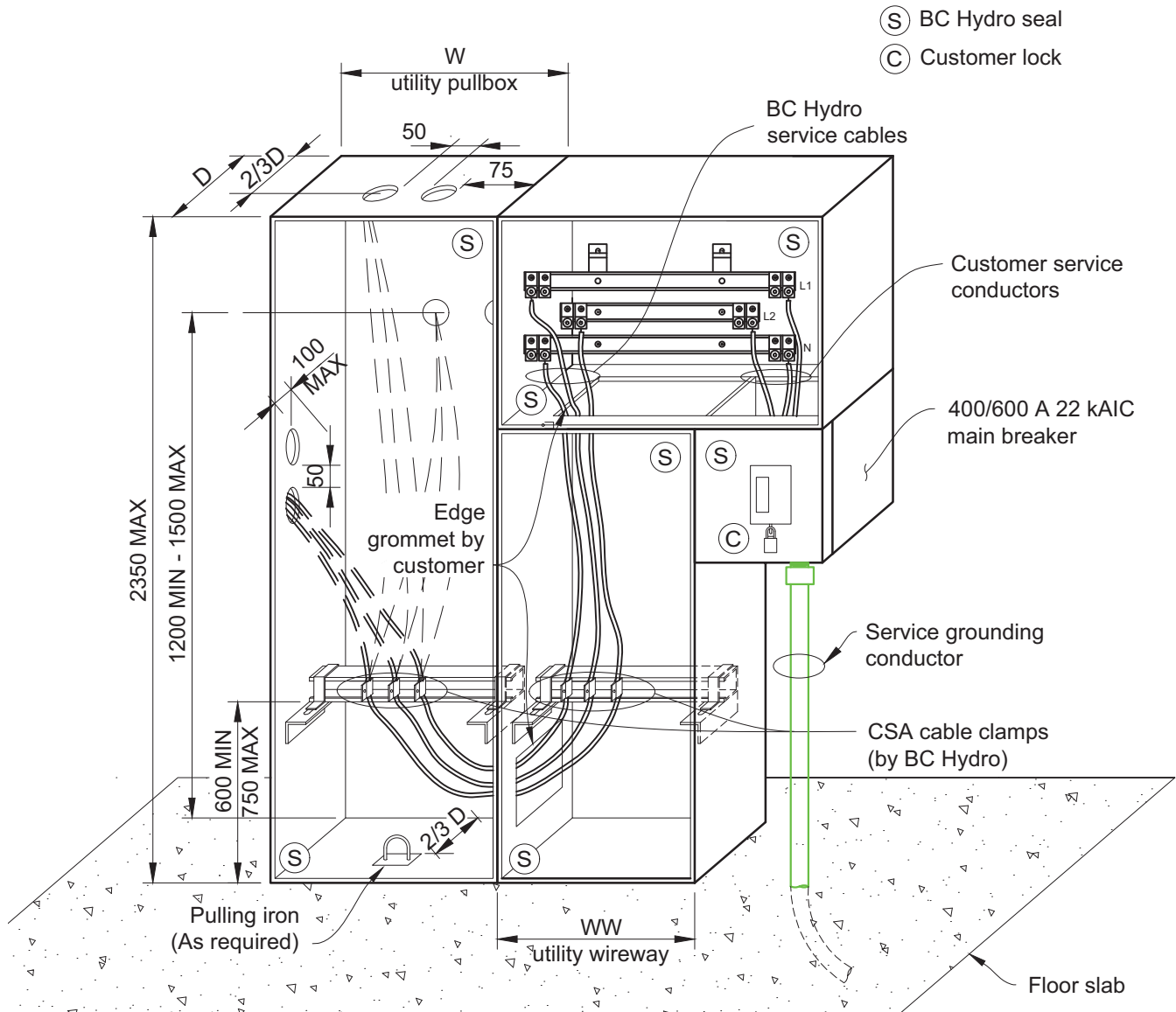


Figure 13 – Customer service main top, rear, or side entry, field assembled, indoor or outdoor

Table 3 – Minimum size of pull boxes and wireways for service equipment
up to 600 A 120/240 V or mid-cable run

Main Switch/ Breaker Size	Duct Size and Quantity (note 2)	Minimum Pull Box Size (mm)				Minimum Wireway Bottom Entry Size (mm)		Minimum Height (H)
		Side and Top Entry		Rear Entry				
		Width (W)	Depth (D)	Width (W)	Depth (D)	Width (WW)	Depth (D)	
Up to 200A	1 x 3"	800	500	500	800	300 (note 1)	200	1200
Up to 400 A	1 x 3"	800	500	500	800	300 (note 1)	300	1200
Up to 600 A	2 x 3"	800	500	500	800	450	300	1200

Table notes:

1. 300 mm minimum wireway width acceptable for vertically staggered bus extensions.
450 mm minimum wireway width required for horizontally staggered bus extensions.
2. 900 mm W x 1800 mm H x 800 mm D minimum size for any customer-owned mid-run pull boxes
wall mounted inside.