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REVISIONS: UPDATED LEGAL ACKNOWLEDGEMENT FORM. FD MAR '16

DESIGNED J. AGNOLIN	RECOMMENDED  F. DENNERT	ACCEPTED  G. REIMER	ENGINEER OF RECORD 	NOTICE FROM THE EXECUTIVE VICE PRESIDENT TRANSMISSION AND DISTRIBUTION AND CUSTOMER SERVICE	
DISTRIBUTION STANDARDS 		ISSUED: MAR 2016 REPLACES: MAY 2004 ORIGINALLY ISSUED: NOV 1980		PAGE 1 OF 2	ES43/53/54/55/65 A1-01.01
					R 4

Scope

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

Purpose of Standards

BC Hydro objectives require standardization to:

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

Responsibility

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

Use of Stock Materials

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

Revisions to Manual

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

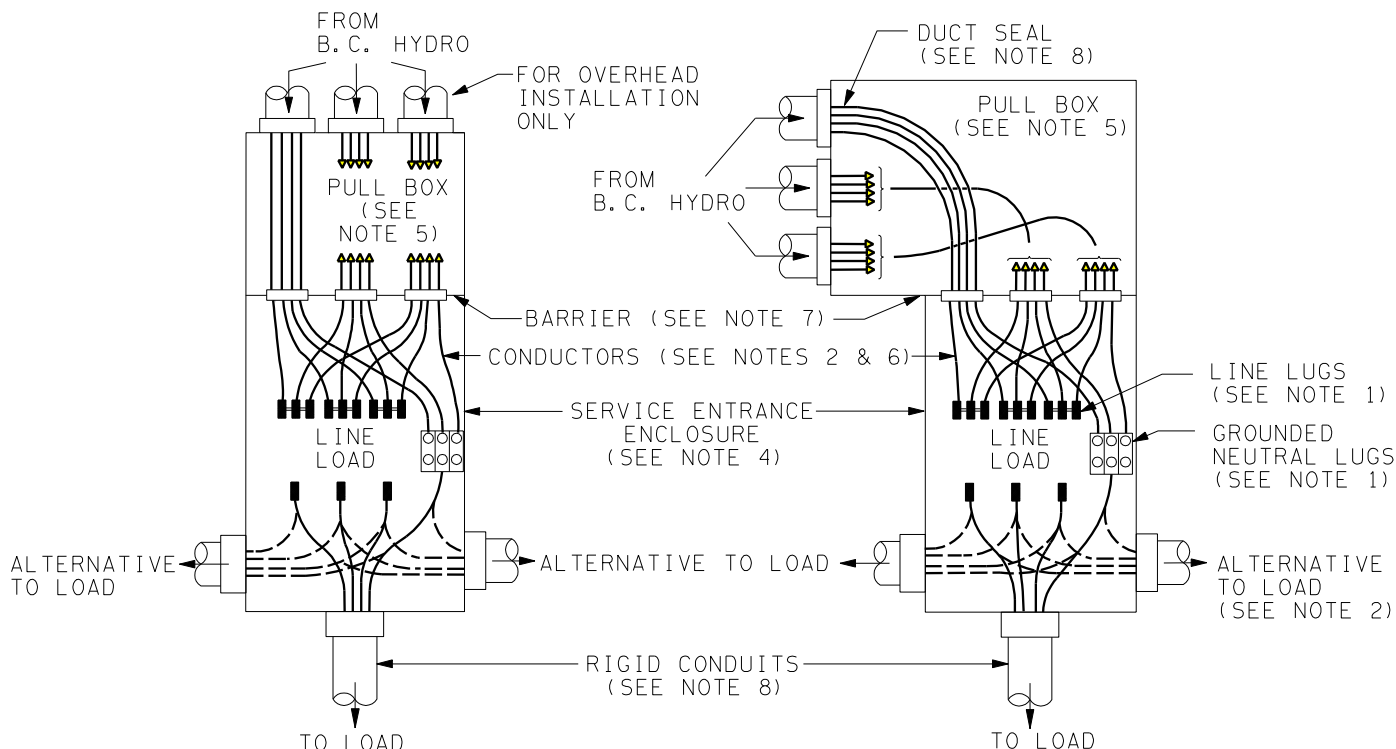
Mailing Addresses

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

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

REVISIONS: UPDATED LEGAL ACKNOWLEDGEMENT FORM. FD MAR '16

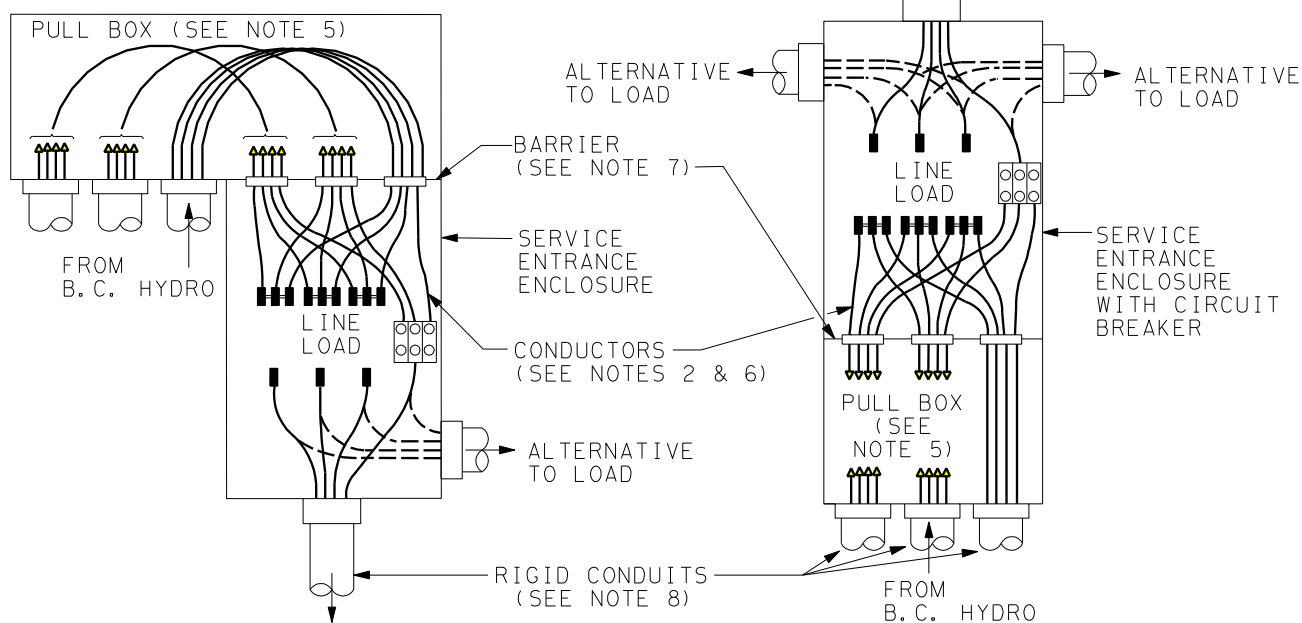
DESIGNED J. AGNOLIN	RECOMMENDED  F. DENNERT	ACCEPTED  S. REIMER	ENGINEER OF RECORD 	NOTICE FROM THE EXECUTIVE VICE PRESIDENT TRANSMISSION AND DISTRIBUTION AND CUSTOMER SERVICE		
DISTRIBUTION STANDARDS  BC Hydro		ISSUED: MAR 2016 REPLACES: MAY 2004 ORIGINALLY ISSUED: NOV 1980		PAGE 2 OF 2	ES43/53/54/55/65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



B.C. HYDRO ENTRY AT THE TOP

B.C. HYDRO ENTRY ON THE SIDE

(LEFT HAND ENTRY SHOWN)



B.C. HYDRO ENTRY AT THE BOTTOM
(LEFT HAND ENTRY SHOWN)

ALTERNATE B.C. HYDRO ENTRY AT THE BOTTOM
FOR CIRCUIT BREAKERS ONLY

DESIGNER	RECOMMENDED	APPROVED	SECONDARY SERVICES THREE PHASE TO 1600A, 208V AND 600V SERVICE ENTRANCE ENCLOSURE DETAILS
A. JACOB	C. PICASSI	F. DENNERT	
ORIGINAL ISSUE DATE: FEBRUARY 1981			

NOTES:

1. Position, quantity and type of line lugs and neutral lug in the service entrance equipment may vary with manufacturer and service size. There must be one lug for each service conductor.
2. Under no circumstances shall load conductors cross or otherwise interfere with the incoming BC Hydro conductors.
3. Service entrance equipment shall be adequately rated for the available fault levels. Consult district or divisional engineering about the available fault levels.
4. Service entrance enclosure shall facilitate a fusible switch enclosure or a circuit breaker. For single service 200 A or less at 120/208 V, service entrance enclosure shall be the meter base, provided that fault level is less than 10kA. Above 10kA, over current protection device must be installed ahead of meter base.
5. Some services 200 A or less with top entry (see note 3.5b on ES54 S2-01.06) or with alternate bottom entry for circuit breaker may not require a pullbox. See drawings ES54 S2-01.01 to S2-01.16 for details.
6. Minimum bending radius for any conductor shall be in accordance with drawing ES53 U1-01.
7. Barrier between the pullbox and service entrance enclosure may not exist or may be slotted to allow conductors to be broken out of the bundle in the pullbox. For steel barrier, conductors must remain in the bundle when passing through barrier to prevent eddy currents. If conductors must be broken out of the bundle chase nipples made of aluminum must be used.
8. All service ducts shall be rigid type conduits with sealed factory bends and fittings sealed thoroughly with duct seal (Stock No. 141-1345) at the point where BC Hydro conductors enter the pullbox.
9. This drawing is based upon customer service instructions (CSIs) S10-1 and S10-3.
10. All 120/208V services larger than 800A and 347/600V services larger than 600A shall be served from padmount transformers only.
11. In the event that there is a conflict between Section "S" of ES53 Standards and the Requirements for Secondary Voltage Revenue Metering 700V and less, the latter takes precedence for Metering Applications only.

DRAFTER: DM

DESIGNER	RECOMMENDED	APPROVED
A. JACOB	C. PICASSI	F. DENNERT
ORIGINAL ISSUE DATE: DECEMBER 1989		

SECONDARY SERVICES THREE PHASE TO 1600A, 208V AND 600V SERVICE ENTRANCE INSTALLATION NOTES

BChydro  **DISTRIBUTION STANDARDS**

PAGE 2
OF 6

ES53 S2-01.02

R. 7

LIST OF CONDUCTOR SIZES AND STOCK NUMBERS
TO SINGLE COMMERCIAL AND INDUSTRIAL CUSTOMERS ON PRIVATE PROPERTY,
WITH 80% RATED MAIN BREAKER

3 Phase (Quadruplex)

Customer Main Switch/Breaker Size	Aluminum			Copper		
	No. of Bundles	Size	Stock Number	No. of Bundles	Size	Stock Number
Up to 125A	1	#1 AWG	382-3111	N/A	N/A	N/A
200A	1	#4/0 AWG	382-3112	1	#1/0 AWG	380-1978
400A	1	500 kcm	382-3115	1	350 kcm	380-1975
600A	2	350 kcm	382-3114	2	#4/0 AWG	380-1977
800A	2	500 kcm	382-3115	2	350 kcm	380-1975
1200A	3	500 kcm	382-3115	3	350 kcm	380-1975
1600A	4	500 kcm	386-3115	4	350 kcm	380-1975

NOTES:

1. The peak demand was assumed to be 80% of the rating of the main service entrance breaker, and the load factor 0.8 (or 80%), as per note 2.
2. Cable ampacity has been calculated using a Load Factor (LF) of 0.8 and the corresponding multiplying factors, where LF is defined based on a 24 hour cycle as per ES53 U1-01.06.
3. Cable ampacities in conduits are as per BCH standard ES53 U1-01.03 R.4.
4. Cable ampacities in vertical runs at the terminal pole are based on the following assumptions:
 - Ambient air temperature of 30° C
 - Wind speed of 2 ft/s
 - Parallel runs use large cable guards and the two sets of cables are strapped to the pole individually, so that they are not in contact.
5. The maximum number of U/G ducts is 4 and the maximum number of parallel runs at the terminal pole is 2.
6. The maximum service size supplied from a bank of polemounted transformers is 800A, due to the limitation of 2 runs at the terminal pole.

DRAFTER: DM	DESIGNER	RECOMMENDED	APPROVED	SECONDARY SERVICES THREE PHASE TO 1600A, 208V AND 600V CONDUCTOR SIZES FOR 80% RATED CUSTOMER SERVICE BREAKER		
	A. JACOB	C. PICASSI	F. DENNERT			
	ORIGINAL ISSUE DATE: FEBRUARY 2007					
	BChydro  DISTRIBUTION STANDARDS			PAGE 3 OF 6	ES53 S2-01.03	R. 7

LIST OF CONDUCTOR SIZES AND STOCK NUMBERS TO SINGLE COMMERCIAL AND INDUSTRIAL CUSTOMERS ON PRIVATE PROPERTY, WITH 100% RATED MAIN BREAKER

3 Phase (Quadruplex)

Customer Main Switch/Breaker Size	Aluminum			Copper		
	No. of Bundles	Size	Stock Number	No. of Bundles	Size	Stock Number
Up to 125A	N/A	N/A	N/A	N/A	N/A	N/A
200A	1	#4/0 AWG	382-3112	1	#1/0 AWG	380-1978
400A	1	500 kcm	382-3115	1	350 kcm	380-1975
600A	2	500 kcm	382-3115	2	350 kcm	380-1975
800A	2	750 kcm	382-3116	2	500 kcm	380-1990
1200A	3	750 kcm	382-3116	3	500 kcm	380-1990
1600A	N/A	N/A	N/A	4	500 kcm (Note 5)	380-1990

NOTES:

- The peak demand was assumed to be 100% of the rating of the main service entrance breaker, and the load factor 0.8 (or 80%), as per note 2.
- Cable ampacity has been calculated using a Load Factor (LF) of 0.8 and the corresponding multiplying factors, where LF is defined based on a 24 hour cycle as per ES53 U1-01.06.
- Cable ampacities in conduits are as per BCH standard ES53 U1-01.03 R.4.
- Cable ampacities in vertical runs at the terminal pole are based on the following assumptions:
 - Ambient air temperature of 30° C
 - Wind speed of 2 ft/s
 - Parallel runs use large cable guards and the two sets of cables are strapped to the pole individually, so that they are not in contact.
- The following additional requirements apply to 1600A services with 100% rated main service breaker:
 - The customer must provide to BCH Design Office the daily load profile;
 - The maximum load must not exceed 1600A;
 - The 24 hours average load must not exceed 1280A (0.8 load factor);
 - The maximum load of 1600A is allowed for not more than 8 hours within any 24 hours period.

If the customer cannot demonstrate compliance with all the above requirements, then the service entrance breaker will be required to trip at 1280A, the equivalent of an 80% rated breaker.
- The maximum number of U/G ducts is 4 and the maximum number of parallel runs at the terminal pole is 2.
- The maximum service size supplied from a bank of pole mounted transformers is as per note 10 of ES53 S2-01.02.

DRAFTER: DM	DESIGNER	RECOMMENDED	APPROVED	SECONDARY SERVICES THREE PHASE TO 1600A, 208V AND 600V CONDUCTOR SIZES FOR 100% RATED CUSTOMER SERVICE BREAKER			
	A. JACOB	C. PICASSI	F. DENNERT				
	ORIGINAL ISSUE DATE: FEBRUARY 2007						
	BChydro  <i>DISTRIBUTION STANDARDS</i>			PAGE 4 OF 6	ES53 S2-01.04		R. 7

RECOMMENDED SIZE OF TRANSFORMERS
TO SINGLE COMMERCIAL AND INDUSTRIAL CUSTOMERS ON PRIVATE PROPERTY

Customer Main Switch/ Breaker Size	O/H Bank kVA		PMT kVA	
	High (80%)	Med (60%)	High (80%)	Med (60%)
Up to 125A	3 x 50	3 x 25	150	75
200A	3 x 50	3 x 50	150	150
400A	3 x 100	3 x 100	300	300
600A	3 x 167**	3 x 167**	500	500
800A	N/A	N/A	750*	500
1200A	N/A	N/A	1000*	750*
1600A	N/A	N/A	1500*	1000*

NOTES:

- The following load categories are covered in the transformer selection tables:
 High- average 24 hours load could reach 80% of the peak load, as defined at 2.
 Medium- average 24 hours load could reach 60% of the peak load, as defined at 2.
- The term "peak load" referred to in note 1, is 80% of the main breaker rating for 80% rated breakers and 100% of the main breaker rating for 100% rated breakers.
- The load categories are for guidance only. A designer must assess the load and size the transformer accordingly.
- Services with 100% rated main service breaker are classified as "High" load.
- BCH supplied transformers are suitable for 110% of the nameplate kVA for a maximum duration of 8 hours within a 24 hour period, with a preload of 80% and a maximum temperature rise of 65° C over 30° C ambient. The maximum short-time overload is 130% of the nameplate KVA for a maximum total duration of one hour within a 24 hour period.

* 750kVA, 1000kVA and 1500kVA units are available only with a primary voltage of 24,940V.

** Transformer banks consisting of 167kVA units shall be platform mounted only.
 The preference is to install three phase pad mounted units instead.

DRAFTER: DM

DESIGNER	RECOMMENDED	APPROVED	SECONDARY SERVICES THREE PHASE TO 1600A, 347V/600V TRANSFORMER SIZES FOR SINGLE SERVICE
A. JACOB	C. PICASSI	F. DENNERT	
ORIGINAL ISSUE DATE: FEBRUARY 2007			

BChydro  **DISTRIBUTION STANDARDS**

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RECOMMENDED SIZE OF TRANSFORMERS
TO SINGLE COMMERCIAL AND INDUSTRIAL CUSTOMERS ON PRIVATE PROPERTY

Customer Main Switch/ Breaker Size	O/H Bank kVA		PMT kVA	
	High (80%)	Med (60%)	High (80%)	Med (60%)
Up to 125A	3 x 25	3 x 10	75	75
200A	3 x 25	3 x 25	75	75
400A	3 x 50	3 x 50	150	150
600A	3 x 75	3 x 50	300	150
800A	3 x 75	3 x 75	300	300
1200A	N/A	N/A	500	300
1600A	N/A	N/A	500	500

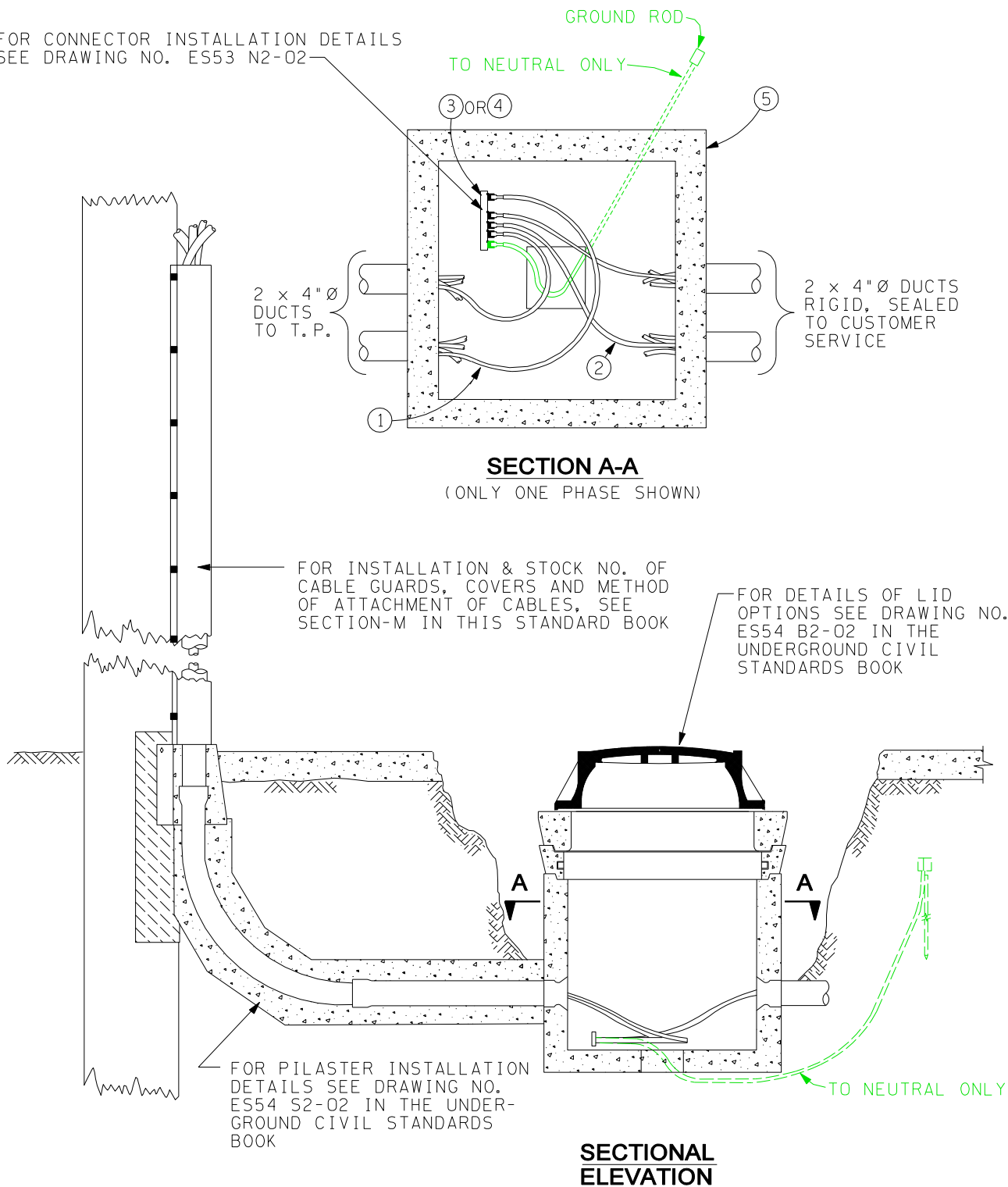
NOTES:

- The following load categories are covered in the transformer selection tables:
 High- average 24 hours load could reach 80% of the peak load, as defined at 2.
 Medium- average 24 hours load could reach 60% of the peak load, as defined at 2.
- The term "peak load", referred to in note 1, is 80% of the main breaker rating for 80% rated breakers and 100% of the main breaker rating for 100% rated breakers.
- The load categories are for guidance only. A designer must assess the load and size the transformer accordingly.
- Services with 100% rated main service breaker are classified as "High" load.
- BCH supplied transformers are suitable for 110% of the nameplate kVA for a maximum duration of 8 hours within a 24 hour period, with a preload of 80% and a maximum temperature rise of 65° C over 30° C ambient. The maximum short-time overload is 130% of the nameplate kVA for a maximum total duration of one hour within a 24 hour period.

DRAFTER: DM

DESIGNER	RECOMMENDED	APPROVED	SECONDARY SERVICES THREE PHASE TO 1600A, 120/208V TRANSFORMER SIZES FOR SINGLE SERVICE
A. JACOB	C. PICASSI	F. DENNERT	
ORIGINAL ISSUE DATE: FEBRUARY 2007			

FOR CONNECTOR INSTALLATION DETAILS
SEE DRAWING NO. ES53 N2-02



DESIGNER RECOMMENDED APPROVED

A. JACOB C. PICASSI F. DENNERT

ORIGINAL ISSUE DATE: OCTOBER 1982

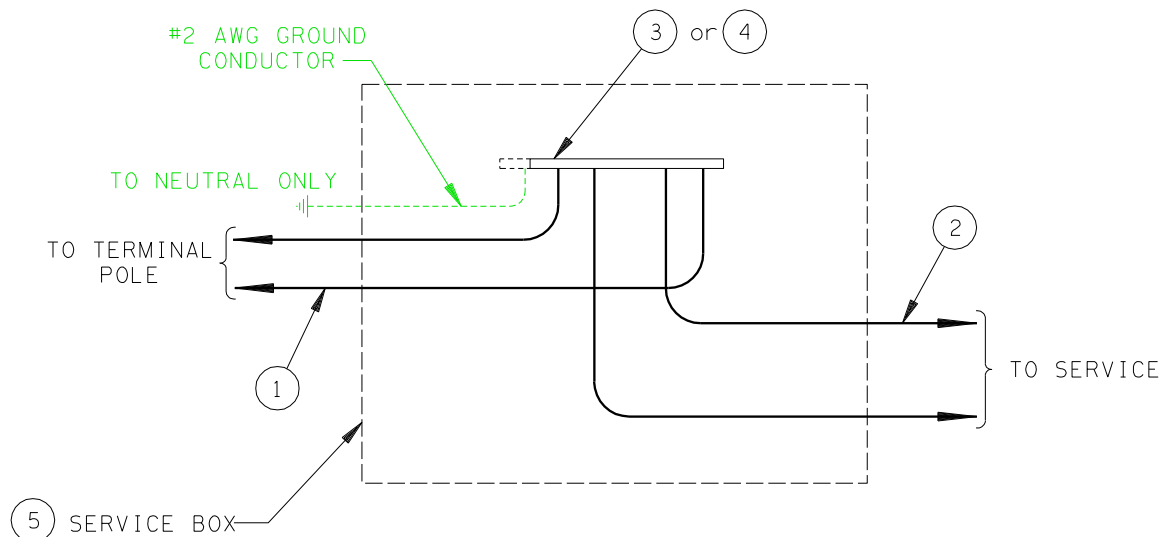
SECONDARY SERVICES
100% RATED 800A MAX. 3 PHASE POLE DIP
WIRING AND INSTALLATION DETAILS

BChydro  **DISTRIBUTION STANDARDS**

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ONE-LINE DIAGRAM OF CONNECTIONS

BILL OF MATERIAL

Item	Quantity	Description	Stock No.
1	2 per phase	Cable, 4/C - 500kcm - Cu	380-1990
2	2 per phase	Cable, 4/C - 500kcm - Cu	382-1990
or	2 per phase	Cable, 4/C - 750kcm - Al	380-1116
3	3	Insulated Secondary Multi-connector, 1000A, 5 Terminal	388-2405
4	3	Insulated Secondary Multi-connector, 1000A, 6 Terminal	388-2406
5	1	332 Concrete Box as required	400-0998
6	1	332 Box Riser	400-0989
7	1	332 M/H Lid Riser	400-0983
or	1	332 Lid Collar	400-0999

NOTES:

- For stock numbers of insulated secondary multi-connectors accessories see drawing ES53 Z4-08.
- The highest allowed load factor for this type of installation is 0.4 (40%). Services supplying customers with higher load factors cannot be provided by using this standard.
- The selected cable sizes are suitable for services with 100% rated main breakers.

ES54 S2-02 3 Phase Dip Service, 1200A, Civil Details
 ES54 B2-05 332 S.B. - Civil Details
 ES53 Z4-08 Multi-connector - 600A Compression
 ES53 N3-01 Service Box Capacities
 ES53 M Sect. Terminal Pole Structures
 ES53 M3-01 Multi-connector - 600A Compression

REFERENCE DRAWINGS

DRAFTER: DM	DESIGNER	RECOMMENDED	APPROVED	SECONDARY SERVICES 100% RATED 800A MAX. 3 PHASE POLE DIP WIRING AND INSTALLATION DETAILS		
	A. JACOB	C. PICASSI	F. DENNERT			
	ORIGINAL ISSUE DATE: OCTOBER 1982					
	BChydro  DISTRIBUTION STANDARDS			PAGE 2 OF 2	ES53 S2-02.02	R. 6

REFERENCE: This standard is based on BC Hydro's Distribution instructions S10-1 and S10-3, as well as information contained in BC Hydro ES54 S2 applicable standards.

6.0 SECONDARY SERVICE REQUIREMENTS:

1. Customer should discuss all aspects of new service with the local BC Hydro representative and the inspection authority prior to commencement of work.
2. Customer shall submit three sets of project drawings of the proposed conduit service run from the property line to the point of delivery as per ES54 S2-01.
3. For services larger than 600A BC Hydro prefers switchboard assemblies with a wireway set out in ES54 S2-01.16. 1200A and 1600A services shall be supplied from padmounted transformers.
4. Padmount transformers on private property shall be installed per CEC Rule 26-242, with required minimum clearance from any door, window, ventilation openings, or combustible surface or material.
5. All service ducts shall be installed 900mm minimum below grade perpendicular to the property line. All ducts shall be rigid type conduits with sealed factory bends and fittings. All ducts and pull strings for cable pulling must be inspected by BC Hydro prior to backfilling.
6. Any deviation from this underground standard must be approved by the BC Hydro district/ area manager or distribution supervisor. Any deviation not approved may delay or force cancellation of service until corrected.
7. Customer must obtain approval from the local electrical inspector for the following:
 - (a) All material and methods of installation on private property.
 - (b) Transformer pad location.
 - (c) Final inspection of the installation.
8. For additional information refer to ES54 S2-01.

DESIGNER	RECOMMENDED	APPROVED
M. KELVIN	M. KELVIN	F. DENNERT
ORIGINAL ISSUE DATE: NOVEMBER 1995		

SECONDARY SERVICE
 PULLBOXES AND SWITCHBOARDS
 INSTALLATION REQUIREMENTS

2.0 PULLBOXES - GENERAL

Refer to ES54 S2-01.06

3.0 PULLBOX LOCATED AT THE SERVICE ENTRANCE

Refer to ES54 S2-01.06

4.0 PULLBOX LOCATED AT THE SERVICE ENTRANCE OF SWITCHBOARD ASSEMBLY

Refer to ES54 S2-01.07

5.0 INFORMATION TO BE SUPPLIED BY CUSTOMER

Refer to ES54 S2-01.08

NOTE:

All service conduits shall be rigid type with sealed factory bends and fittings. BC Hydro does not accept EMT type conduits for exposed or concrete encased service runs.

DRAFTER: DC

DESIGNER
M. KELVIN

RECOMMENDED
M. KELVIN

APPROVED
F. DENNERT

ORIGINAL ISSUE DATE: NOVEMBER 1995

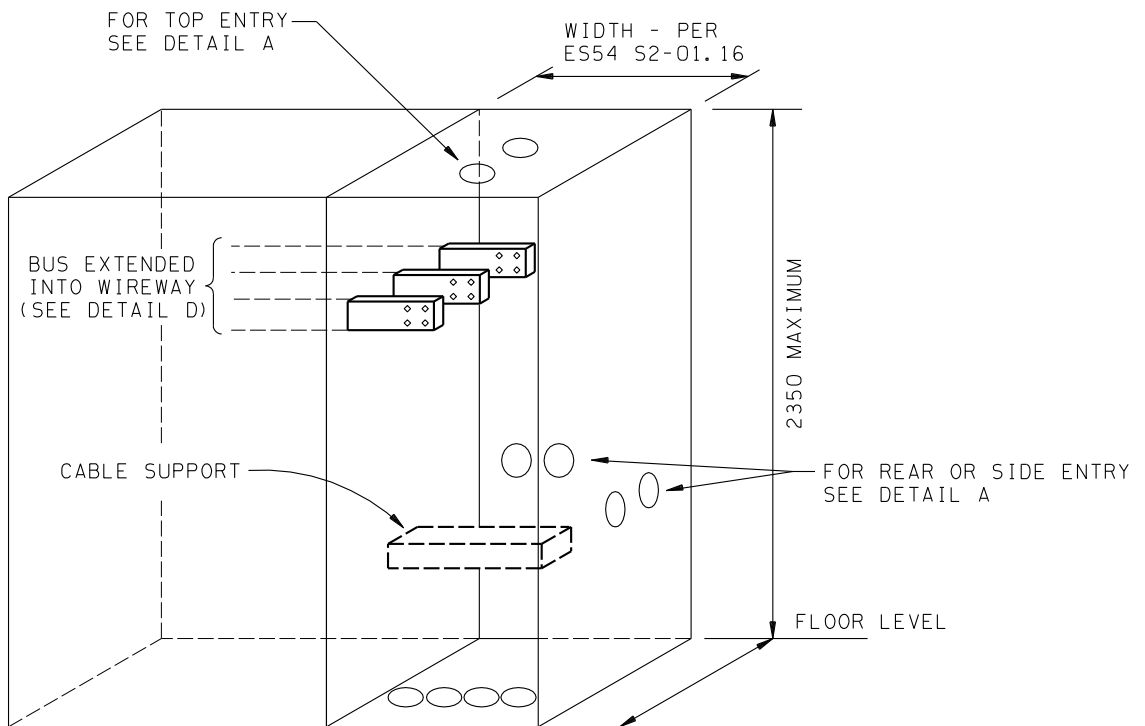
SECONDARY SERVICE PULLBOXES AND SWITCHBOARDS INSTALLATION REQUIREMENTS

BChydro  **DISTRIBUTION STANDARDS**

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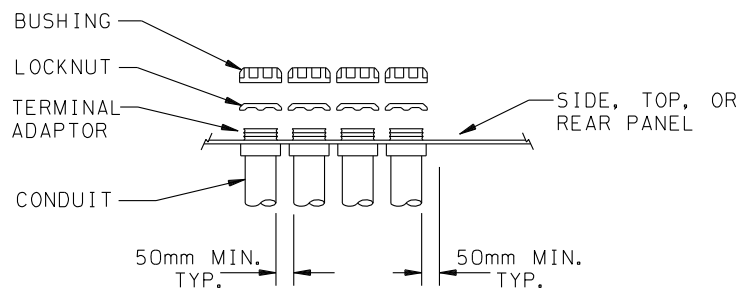
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NOTE: FOR EXACT DETAILS AND CONDUIT LAYOUT SEE ES54 S2-01.13

Customer Main Switch Size	No. and Size of Conduits	No. of Runs and Size of Quad. (Al.)	No. of Runs and Size of Quad. (Cu.)
1200 A	3 x 4"	3 x 4C 500 kcm	3 x 4C 350 kcm
1600 A	4 x 4"	4 x 4C 500 kcm	4 x 4C 350 kcm

3Ø SECONDARY 1200 TO 1600 AMP MAIN SWITCH



LINE CONDUIT ASSEMBLY DETAIL A

DRAFTER: JMW

DESIGNER
R. MAH

RECOMMENDED
M. KELVIN

APPROVED
F. DENNERT

ORIGINAL ISSUE DATE: MARCH 1996

SECONDARY SERVICES PULLBOXES AND SWITCHBOARDS INSTALLATION REQUIREMENTS

BC Hydro  **DISTRIBUTION STANDARDS**

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ES53 S2-03.03

R. 3

TABLE 1

**SIZE OF PULLBOXES AND WIREWAYS INSTALLED IN A BUILDING
AT SERVICE ENTRANCE EQUIPMENT OR MID-CABLE RUN**

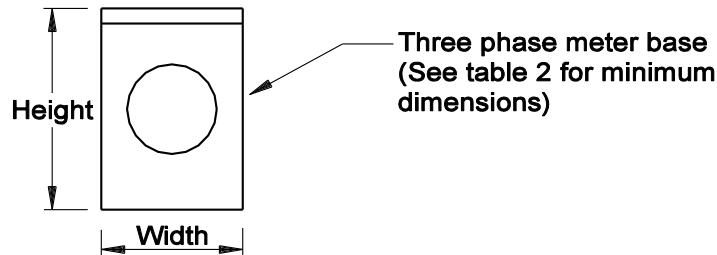
Main Switch/ Breaker Size	Number and Size of Conduits		Minimum Pullbox Dimensions (mm)			Minimum Wireway Dimensions (mm)	
	1 Phase	3 Phase	Width (W)	Depth (D)	Height (H)	Width (W)	Depth (D)
Up to 225A	1 x 3"	1 x 4"	600	230	600	300	200
400A	1 x 3"	1 x 4"	600	300	600	300	300
600A	2 x 3"	2 x 4"	600	350	750	450	300
800A	N/A	2 x 4"	900	350	750	450	300
1200A	N/A	3 x 4"	900	350	900	600	450
1600A	N/A	4 x 4"	900	450	900	750	450

NOTE: This table is not to be used for rear entry pullboxes.

TABLE 2

SIZES OF THREE PHASE METER BASES FOR SERVICES UP TO 200A

Type of Meter Enclosure	Minimum Outside Dimensions (mm)			Knockout Size	Minimum Line Connector Range
	Height (H)	Width (W)	Depth (D)		
Three Phase up to 200 Amps	480	295	135	To Accept 3" Conduit	#2-3/0 Cu #2-250 kcm Al



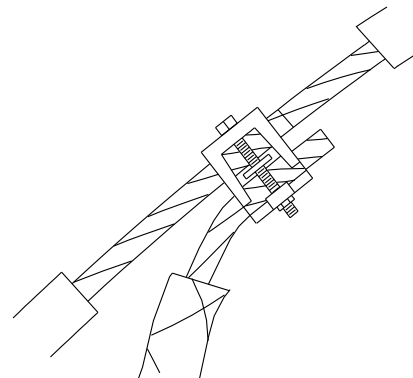
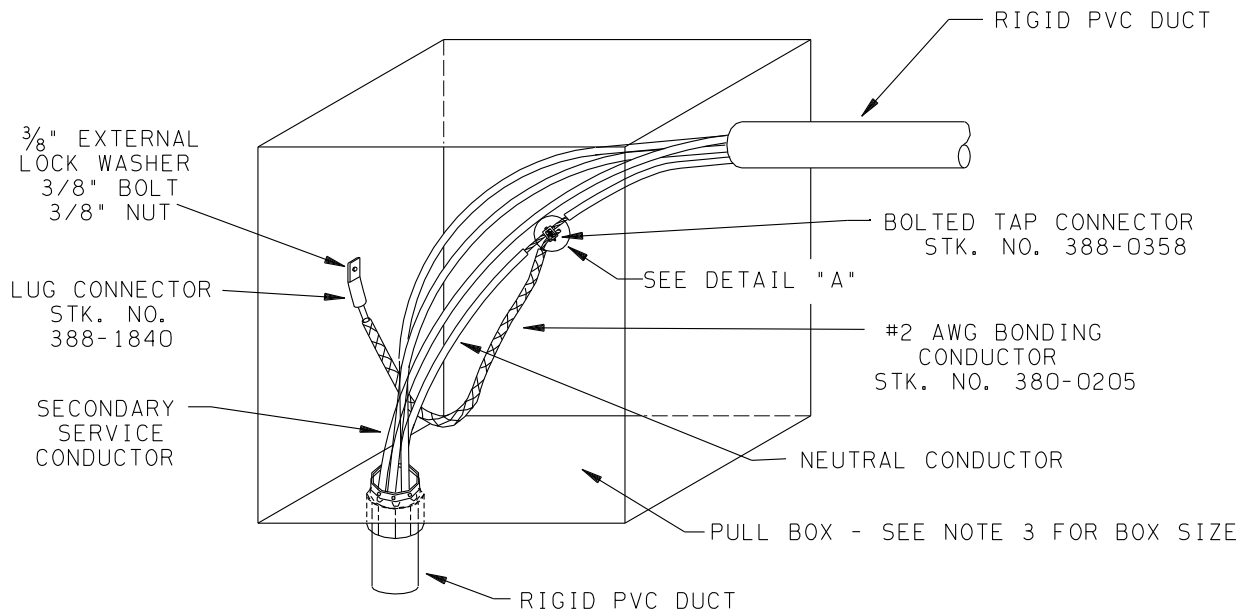
BCH "Guide for Secondary Metering"

- ES54 U4 Service Installation in Unstable Ground
- ES54 H2-04 Reinforcing Details for Concrete Encasement
- ES54 H1-01 Trenching Details
- ES54 F Section Transformer Pads
- ES54 B1-01 Pullbox, Cast in Place
- ES53 U1-04 Cables, Pulling Parameters
- ES53 U1-01 Cables, Physical Properties
- ES53 S2-01 Service Wiring Details

REFERENCE DRAWINGS

DRAFTER: JMW	DESIGNER M. KELVIN	RECOMMENDED M. KELVIN	APPROVED R. DENNERT	SECONDARY SERVICE PULLBOXES AND SWITCHBOARDS INSTALLATION REQUIREMENTS			
	ORIGINAL ISSUE DATE: JUNE 1987						
	BChydro  DISTRIBUTION STANDARDS			PAGE 4 OF 4	ES53 S2-03.04		R. 3

R1-DWG. NO. REVISED MAR. '96 MF



**BOLTED TAP CONNECTOR
DETAIL "A"**

NOTES:

1. Bonding as shown above is required when a metallic pullbox has a service conduit of non-conductive material such as rigid PVC. (Floating box)
2. BC Hydro primary service cables are all shielded and don't have to be bonded to the pullbox.
3. Pullbox size 36"W x 72"H x 12"D, hinged door c/w 2-pentahead bolts and padlock hasp.

DRAFTER: JMW	DESIGNER M. FISCHER		RECOMMENDED M. KELVIN	APPROVED F. DENNERT	SECONDARY SERVICES PULLBOX BONDING			
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