

BULLETIN 2005-004-EL

Revised May 7, 2008

TESTING/COMMISSIONING OF HIGH VOLTAGE STATIONS AND UNIT SUBSTATIONS

BACKGROUND

Rule 36-304(4) of the CEC, Part I mandates that "after completion of construction, the resistance of the station ground electrode at each station shall be measured and changes shall be made if necessary to verify and ensure that the maximum permissible resistance of Subrule (1) is not exceeded". It is intended by this requirement of the Code that a detailed testing/commissioning of all components comprising a High Voltage Station is undertaken to ascertain acceptable levels of step and touch voltages in conformance with Table 52 and of potential rise not more than 5000 Volt at all parts of the station ground grid under maximum ground fault current conditions.

REQUIREMENTS

This Bulletin establishes the City of Vancouver testing/commissioning requirements for the purpose of Rule 36-304(4). When an electrical installation includes a High Voltage component, such installation **shall not be energized** until a testing/commissioning report is provided to the City Electrician by an acceptable independent agency (other than the installing electrical contractor). The commissioning report submitted by the independent agency must indicate that the High Voltage Station or a Unit Substation has been successfully tested in accordance with provisions of Section 36 of the CEC, Part I, and that the installation is ready to be energized.

The testing/commissioning report must include (but not be limited to) the following:

1. Operation of all required interlocks between fuse compartments, load breaking or isolating means;
2. Operation of all isolating and disconnecting means;
3. Insulation resistance of all isolating and disconnecting means;
4. Contact resistance of all insulating and disconnecting means;
5. Protection coordination study;
6. Step and touch voltages calculations and ground resistance test.
7. Visual inspection of all isolating and disconnecting means;
8. Hi-Pot test of all isolating and disconnecting means and the cells for termination of the incoming BC Hydro cables;
9. Visual inspection of transformer(s);
10. Transformer insulation resistance test (Megger test);
11. Transformer "Turn to turn ratio" (TTR) test on all taps;
12. Transformer winding temperature test (test of WTI trip);
13. Visual inspection of all connections to the Station Ground Electrode;
14. Confirmation that all interconnections between pieces of electrical equipment assembled on the site into a "unit substation" are in compliance with the CEC, Part I and with the shop drawings provided by the supplier of the "unit substation".
15. Confirmation that the tested High Voltage Station or Unit substation is ready to be energized.

(Applicable checklists (Attachments 1-3) must be completed and submitted with the commissioning report.)

(Original signed by)

(Original signed by)

W. White
Deputy City Electrician
Manager, Trades Inspection

P. Ryan, M.Sc., P.Eng.
Chief Building Official
Director, Building Code and Policy

Attachments 1, 2 and 3

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ATTACHMENT 1

H.V. Unit Substations Checklist

Installation Address: _____ Permit Number EP- _____

Note 1: To be completed by the Professional Engineer of the Testing/Commissioning Agency

Note 2: For information requirements of a portable unit substation used in the installation for a special event, refer to **COV Bulletin 2000-048-EL**

Item	Description	References (Applicable CEC Rules, C.O.V. Bulletins)	Conformance to the referenced requirements	
			Yes	No
1	H.V. Station Ground Resistance Report (See Attachment 2)	36-304		
2	H.V. Equipment approval Note: Includes equipment comprising a unit substation	2-024		
3	Clearance and spacing of live parts	36-108; 36-110; 36-212; Tables 30, 31, 32, 33, 34 &35		
4	Operation of H.V. switches	36-212; 36-214		
5	Interlocks	36-208; 36-214		
6	Switch, fuse, and breaker ratings	36-202; 36-204		
7	Transformer overload and overheating protection:	26-252		
	(a) Relay and tripping device settings			
	(b) Transformer core temperature device			
8	Installation integrity:	As per shop drawings		
	(a) Insulation			
	(b) Torqued as per installation specifications			
	(c) Stand-off supports and bushings			
9	Interconnection between pieces of electrical equipment assembled on site is in conformance with the shop drawings and in accordance with the CE Code Part I	Shop drawings of unit substation; CE Code, Part I		
10	Tested H.V. Station (Unit Substation) is ready to be energized	Item 15 of : Bulletin 2005-004-EL		

Additional Comments: _____

Testing Agency: _____

Name: _____ **P.Eng.**

Address: _____ **Affix Professional Seal**

Telephone: _____

Facsimile: _____

Email: _____

Signature: _____ **Date:** _____

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ATTACHMENT 2

H.V. Service General Checklist

Installation Address: _____ Permit Number **EP-**_____

Note 1: To be completed by the Professional Engineer of the testing agency or by the Professional Engineer responsible for the design of the H.V. installation. (P.Eng. of record)

Note 2: For information requirements of a portable unit substation used in the installation for a special event, refer to **COV Bulletin 2000-048-EL**

Note 3: Completed report - to be provided as part of Attachment 1 (Item 1)

High Voltage Station Ground Resistance Report			
Item	Requirements of Table 52	Conformance with applicable requirements of Table 52	
		Yes	No
1	Type of Soil (specify):		
2	Measured Resistance of the station Ground Electrode		
3	Calculated Step Voltage at the HV station		
4	Calculated Touch Voltage at the HV station		

Testing Agency: _____

Company Name:
(if other than the testing agency) _____

Name: _____ **P.Eng.**
Affix Professional Seal

Address: _____

Telephone: _____

Facsimile: _____

Email: _____

Signature: _____ **Date:** _____

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ATTACHMENT 3

H.V. Service General Checklist

Installation Address: _____ Permit Number EP- _____

Note 1: To be completed by the Professional Engineer responsible for the design of the H.V. installation. (P.Eng. of record)

Note 2: For information requirements of a portable unit substation used in the installation for a special event, refer to
COV Bulletin 2000-048-EL

Item	Description	References (Applicable CEC Rules, C.O.V. Bulletins)	Conformance to the referenced requirements		
			Yes	No	N/A
1	Horizontal clearance of H.V. conductors from adjacent structures; guarding	36-004; 36-110; Table 33; Bulletin 2015-002-AD/EL			
2	Service raceways, including drainage and pull box facilities	2-322; 6-300; 12-944; 36-100; Bulletin 2000-028-EL Bulletin 2003-002-EL Bulletin 2007-003-EL			
3	Working space; entrance to and exit from; marking to warn persons of potential electric shock and arc flash hazards.	2-306; 2-308; 2-310; Table 56			
4	Space for service and distribution equipment	6-206; 26-352- 36-200 Bulletin 2000-045-EL			
5	Access to nameplates and parts requiring maintenance	2-122			
6	Presence of other than electrical equipment	2-124; Bulletin 2000-045-EL			
7	(a) Dielectric liquid-filled equipment, indoors	26-012; 26-246; 36-206;			
	(b) Dielectric liquid-filled equipment, outdoors	26-014; 26-242; 36-212; Bulletin 2015-002-AD/EL			
8	Illumination of equipment	2-316; 26-356			
9	Warning notices	36-006			
10	Electrical equipment service room/Vault	26-012			
	(a) Location	36-200			
	(b) Construction	ARTICLE 3.6.2.1. / 3.6.2.7 DIVISION B VBBL			
	(c) Door Swing	3.6.2.6.(1) DIV. B VBBL			
	(d) Fire alarm system devices (Smoke detectors if not sprinklered)	Bulletin 2000-045-EL 3.6.2.7.(3)(b) DIV. B VBBL			
	(e) Adjacent Hazardous Areas (Commercial repair garages)	20-102			
	(f) If sprinklered, adequate protection for electrical equipment	26-008; 26-248(5); Article 8.15.11.3 NFPA 13			
11	Ventilation	VBBL DIV. B 3.6.2.7(6) 2-320; Appendix B; P. Eng. Ltr			
	(a) Proof that the system is adequate and suitable for the purpose				
	(b) Intake location	VBBL DIV. B 6.2.3.12			

Item	Description	References (Applicable CEC Rules, C.O.V. Bulletins)	Conformance to the referenced requirements		
			Yes	No	N/A
12	Grounding and bonding requirements:	Bulletin 2005-004-EL			
	(a) Station ground electrode	36-300; 36-302			
	(b) Connections to the station ground electrode	36-104(5); 36-308; Appendix B			
	(i) Method of connection (as specified by the design professional)	36-300; 36-308; Appendix B			
	(ii) Conductor sizes (as specified by the design professional)	CEC Table 51			
	(c) If a ground bus (pad) for testing purposes is installed:				
	(i) Accessibility	2-312			
	(ii) Conductors marked for testing purposes	36-308(7); 2-100			
	(d) If a gang-operated switch is installed:				
	(i) Operating shaft grounded	36-310(1)(a) or (b)			
	(ii) 1.2 m X 1.8 m gradient control mat				
	(iii) positioned for vertical or horizontal operation				
	(iv) connection of the mat by two separate conductors (size and method of connection as specified by the design engineer)				
	(e) If a metallic fence is installed:				
(i) located minimum 1 m inside perimeter of station ground electrode area					
(ii) connections to the fence					
13	L.V. breakers and fuses:	Section 14			
	(a) Size/trip setting	Accepted Plans and Specifications			
	(b) Interrupting capacity	14-012; 14-014;			
14	Ground Fault protection or ground fault detection device.	14-102; 10-106(2)			
15	Seismic restraints	VBBL DIV. B 4.1.8.18			
16	Other - (Please specify)				

Additional Comments: _____

Testing Agency: _____

Name: _____

Address: _____

Telephone: _____

Facsimile: _____

Email: _____

Signature: _____ Date: _____

P.Eng.
Affix Professional Seal