
Customer Owned High Voltage Installations

With the increase in customer own high voltage equipment there appears to be confusion over which standards should be followed and as to if this work is required to be performed under a Wiring Permit and be inspected.

The Nova Scotia Electrical Code Regulations requires that all electrical installation, unless exempted, must be performed under a wiring permit and be inspected by the Inspection Department before the equipment is energized. These requirements apply to all customer owned high voltage installations (voltages operating in excess of 750V).

In addition to permit and inspections requirements, electrical drawings for high voltage installations must be submitted for review in accordance to Electrical Inspection Bulletin B-2-014. Documentation must be provided to support cable ampacity ratings by a P.Eng of Record. Request for deviations along with the rationale for the request must be submitted in writing to the Inspection Department at the time drawings are submitted.

Customer owned high voltage installations may include but are not limited to overhead and underground cables and conductors, pad mount transformers, transformer banks, outdoor and indoor sub-stations, grounding, enclosed switching cubicles, switchgear, sub-station fences, and other equipment operation in excess of 750 volts.

NSPI supply authority must be consulted in all cases prior to any customer's high voltage system being connected or interconnected to NSP's utility system. In addition to meeting the requirement of NSP's supply authority, customer owned installations must comply with the Canadian Electrical Code, Part 1(CEC) and other applicable CSA standards. NSPI utility standards should not be used in designing customer high voltage installations as NSPI utility standards may differ from that of the CEC. Designers and installers must ensure the installation complies with the minimum requirements of the CE Code. Example of one difference is the requirement for disconnecting means for a 3-phase transformer. Utility practice is to install 3 single gang cutouts however CEC rule 36-204 requires a gang operated switch.

High voltage electrical equipment must be approved by a recognized certification agency provided the certification agency has a program to certify the equipment to the appropriate CAN/CSA standard. If the certification agency does not have a program to certify the equipment, the equipment must be built to a recognized CAN/CSA standard. The CSA standards require the equipment to be labeled to the standards it was built to.

However electrical equipment built to CAN/CSA C88 does not require the equipment to be labeled. In this case the customer must provide the Inspection Department written documentation from the manufacture indicating the applicable CAN/CSA standard it was built to, and the customer shall install a label on the equipment noting the applicable standard(s). Where a CAN/CSA standard does not exist other standards may be acceptable as would be the case with equipment operating in excess of 46 kv. The customer/ agent shall provide documentation as to the type of equipment and applicable standard it was built to.

In addition to the requirements of CEC, installations of overhead and underground systems shall also conform to applicable CSA Part 3 standards.

The following table indicates applicable standards for specific high voltage equipment.

Prepared by: David Clements

Approved by: David Clements

High Voltage Equipment	Application	Equipment Standard (see note 1)
Enclosed Switchgear up to 46KV	Indoors or Outdoors within a fenced station	Certified to C22.2 No.31-04
Enclosed Switchgear up to 46KV	Outdoors	Certified to C22.2 No.31-04 (Tamperproof Design)
Air Cooled Distribution Transformer(Dry Type) up to 46kV	Indoors or Outdoors	Certified to C22.2 No.47-M90 (R2007)
Oil/Liquid Filled Power Transformer	Outdoors within fenced in station, or indoor within a vault	Built to CAN/CSA C88-M90 (R2004)
Single and Three Phase Oil/Liquid Filled Distribution Transformer (Up to 3MVA) ONAN only	Outdoors within fenced in station, or indoor within a vault	Built to CAN/CSA-C2.1-06
Single and Three Phase Liquid Filled Distribution Transformer (Up to 3MVA) LNaN only	Outdoors within fenced in station, or indoor within a vault	Built to CAN/CSA-C2.1-06
Low -Profile, Single Phase Tamper Resistant Pad Mount Transformer with Separable Insulated Connectors (Up to 27.6/16.8 kV) (Up to 167 KVA)	Outdoors (no fence required)	Built to CAN/CSA-C227.3 - 06
Three Phase Tamper Resistant Pad Mount Transformer with Separable Insulated Connectors (Up to 27.6/16.8 kV) (Up to 3000 KVA)	Outdoors (no fence required)	Built to CAN/CSA-C227.4 - 06
Three Phase, Live-Front, Pad Mounted Distribution Transformer Tamper Resistance	Outdoors (no fence required)	Built to CAN/CSA C227.5-08
Oil/Liquid Filled Tamper Resistant Pad Mount Transformer ONAN and LNaN only	Outdoors (no fence required)	Built to CAN/CSA C88-M90 (R2004) and built to tamperproof requirements in C227.4

Transformer Designation

ONAN- Oil Filled Natural Cooling

LNaN- Flame-retardant Liquid filled natural cooling

Note 1: The information indicated in the equipment standard column shall appear on the equipment.

Station Ground Resistance

Testing/Commissioning of High Voltage Stations and Unit Substations

In order to ensure compliance with Section 36 of the CEC and in particular rule 36-304(4), (Station ground resistance) after completion of construction equipment shall not be energized until a testing/commissioning report on the complete installation is provided to NSPI's Chief Electrical Inspector, an electrical inspection has been completed by the Inspection Department and all applicable checklists (attachments 1-3) have been submitted with the commissioning report. The testing /commissioning report is to be completed by an acceptable independent agency other than the installing electrical contractor. The report submitted by the agency must indicate that the High Voltage installation has been successfully tested in accordance with requirements of Section 36 of the CEC and that the installation is ready to be energized.

Where an installation falls under the station exemption rule (36-306), the consultant must demonstrate to the Inspection Department that the potential rise of the station shall not exceed the values specified in Table 52 during the lifetime of the station.

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

- (1) Operation of all isolating and disconnecting means;
- (2) Operation of all required interlocks between fuse compartments, load breaking or isolating means;
- (3) CAN/CSA standard that transformer(s) are built to;
- (4) Calculation of step and touch voltages and ground resistance test;
- (5) Protection coordination study;
- (6) Visual inspection of grounding conductors and ground connections
- (7) Confirmation that that all test are completed and the complete installation complies with the CEC and station is ready to be energized.
- (8) Indication that all equipment is rated to withstand the maximum available fault levels

The design of the station ground electrode can be found in CEA Report 249 D541 "Simplified Rules for Grounding Customer-Owned High Voltage Substations or IEEE Standard No. 80 "Guide for Safety in AC Substation Grounding"

Acknowledgements:

References to equipment standards provide by Canadian Standards Association (CSA)
Information contained in checklist provided by City of Vancouver Electrical Inspection Department

ATTACHMENT #1 – to NS Power Electrical Inspection Bulletin 36-000

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

GENERAL CHECKLIST FOR H.V. UNIT SUBSTATION

Project Name: _____ Wiring Permit Number: _____

Installation Address: _____ Plans Review Number: _____

ITEM NO.	DESCRIPTION	REFERENCES (Applicable CEC Rules, NS Power Electrical Inspection Bulletins, NS Power Authority Directives)	Conformance to the referenced requirements	
			Yes	No
1	(a) H.V. Station Ground Resistance Report (See Attachment 2)	36-304		
2	H.V. Equipment approval	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; 14-402		
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 spec.'s			
	(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	NS Power Bulletin 36-000		

Additional Comments: _____

Testing Agency: _____

Name: _____ P.Eng.

Signature: _____

Address: _____

Telephone: _____ Affix Professional Seal

Facsimile: _____

Email: _____

ATTACHMENT #2 – to NS Power Electrical Inspection Bulletin 36-000

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

Note 2: Completed report – to be provided as part of Attachment 1 (Item 1)

GENERAL CHECKLIST FOR H.V. SERVICE

Project Name: _____ Wiring Permit Number: _____

Installation Address: _____ Plans Review Number: _____

HIGH VOLTAGE STATION GROUND RESISTANCE REPORT

Installation Address: _____ Wiring Permit Number: _____

Testing Agency: _____

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		

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

Name: _____ P.Eng.

Signature: _____

Date: _____

Address: _____

Telephone: _____ Affix Professional Seal

Facsimile: _____

Email: _____

ATTACHMENT #3 – to NS Power Electrical Inspection Bulletin 36-000

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

GENERAL CHECKLIST FOR H.V. SERVICE

Project Name: _____ Wiring Permit Number: _____

Installation Address: _____ Plans Review Number: _____

Item No.	DESCRIPTION	REFERENCES (applicable CEC Rules, NS Power Inspection Bulletin and Supply Authority Directives, Dept. of Labour & Workforce Development 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			
2	Service raceways, including drainage and pull box facilities	2-320; 6-300; 12-942; 36-100			
3	Working space; entrance to and exit from	2-308; 2-310; Table 56			
4	Space for service and distribution equipment	6-206; 26-352; 36-200			
5	Access to nameplates and parts requiring maintenance	2-118			
6	Presence of other than electrical equipment	2-120			
7	(a) Dielectric liquid-filled equipment, indoors	26-012; 26-242; 36-212			
	(b) Dielectric liquid-filled equipment, outdoors	26-014; 26-242; 36-212			
8	Illumination of equipment	2-314; 26-356			
9	Warning notices	36-006			
10	Electrical equipment service room/Vault	26-012			
	(a) Location	36-200			
	(b) Construction	NBCC DIV. B 3.6.2.1/3.6.2.7			
	(c) Door Swing	NBCC DIV. B 3.6.2.6			
	(d) Fire alarm system devices (Smoke detectors if not sprinklered)	NBCC DIV. B 3.6.2.7 (3)(b)			
	(e) Adjacent Hazardous Areas	20-102(5)			
	(f) If sprinklered, adequate protection for electrical equipment	26-008; 26-248(5)			
11	Ventilation				
	(a) Proof that the system is adequate and suitable for the purpose	NBCC DIV. B 3.6.2.7(6); 2-318; Appendix B			
	(b) Intake location	NBCC DIV. B 6.2.3.12			

Item No.	DESCRIPTION	REFERENCES (applicable CEC Rules, NS Power Inspection Bulletin and Supply Authority Directives, Dept. of Labour & Workforce Development Bulletins)	Conformance to the referenced requirements		
			Yes	No	N/A
12	Grounding and bonding requirements	CEC Section 10			
	(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:	36-312			
(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 indicator	14-102; 10-106(2)			
15	L.V. metering sockets	NS Power Metering Standards			
16	Other – (Please specify)				

Additional Comments: _____

Company Name: _____

Name: _____ P.Eng.

Signature: _____

Address: _____

Telephone: _____ Affix Professional Seal

Facsimile: _____

Email: _____