



# Provisional Specifications

Category: <b>ELECTRICITY</b>	Provisional Specifications: <b>PS-E-16</b>	Page: <b>1 of 9</b>
Document(s): <b>Provisional Specification for the Approval of Electronic Voltage Transformers, PS-E-15</b>	Issue Date: <b>2007-06-25</b>	Effective Date: <b>2007-06-25</b>
	Supersedes:	

## Provisional Specifications for the Verification, Reverification, Installation and Use of NXVT® Electronic Voltage Transformer

### 1.0 Scope

These provisional specifications apply to the NXVT Electronic Voltage Transformer manufactured by NxtPhase T&D Corporation. For combined electronic voltage and current transformers this provisional specification will be applicable to the electronic voltage transformer.

### 2.0 Authority

These provisional specifications are issued under the authority of sections 12 and 18 of the *Electricity and Gas Inspection Regulations*.

### 3.0 Description

The NXVT is an electronic voltage transformer which uses optical technology (the Pockels effect) to measure voltage, and transform the measured value to a proportional analogue output.

### 4.0 Installation and Use

#### 4.1 General

**4.1.1** Each verified NXVT to be installed and used in obtaining the basis of a charge shall be installed and used in the manner(s) established in the Notice of Approval (NOA) or Conditional NOA as applicable, in addition to that as specified in this document.

**4.1.2** Each verified NXVT shall be installed and used in the manner established by the manufacturer's technical specifications and criteria.

Category: <b>ELECTRICITY</b>	Provisional Specifications: <b>PS-E-16</b>	Page: <b>2 of 9</b>
Document(s): <b>Provisional Specification for the Approval of Electronic Voltage Transformers, PS-E-15</b>	Issue Date: <b>2007-06-25</b>	Effective Date: <b>2007-06-25</b>
	Supersedes:	

## **4.2 Installation**

**4.2.1** The NXVT output connected to a circuit, having the combined burden of meter, associated wiring and connections, and any other secondary connected devices, shall not exceed the approved burden designation of the NXVT.

**4.2.2** The NXVT shall be installed as a complete measurement device which incorporates each of its integrated metrological modules that are identified by its serial number on the verification/reverification documentation.

**4.2.3** Each wire or cable that connects to the input of every metrological module of a NXVT shall be individually identifiable or traceable. Each wire or cable that connects from the output of the NXVT to a meter input shall be individually identifiable or traceable.

## **4.3 Use**

**4.3.1** The verification documentation and all subsequent reverification documentation shall be clearly legible, and readily available at the site location where the NXVT is being used.

**4.3.2** Metrological modules identified by serial number on the verification/reverification documentation shall not be removed, replaced or modified under any circumstances with the exception stated as follows. Removal, replacement or modification of modules may be performed only in instances to correct for an error which resulted in rejection of the NXVT pursuant to the Reverification requirements of section 5.3. The NXVT shall subsequently be verified (either in-situ pursuant to section 5.4 or in test facility pursuant to section 5.2) prior to being used to obtain the basis for a charge.

**4.3.3** Metrological components which are not specifically identified by serial number on the verification/reverification documentation shall not be installed on the NXVT.

**4.3.4** The NXVT user manual shall be available on site upon request by Measurement Canada for the purposes of verification, reverification, installation inspection or dispute investigation.

## **5.0 Verification and Reverification**

### **5.1 General**

**5.1.1** Each NXVT to be verified or reverified shall comply with all terms and conditions established in the NOA, or Conditional NOA as applicable, in addition to all requirements established in this specification. Testing shall be performed in accordance with Measurement Canada requirements and the Procedures for the Verification and Reverification of NXVT Electronic Voltage Transformers.

Category: <b>ELECTRICITY</b>	Provisional Specifications: <b>PS-E-16</b>	Page: <b>3 of 9</b>
Document(s): <b>Provisional Specification for the Approval of Electronic Voltage Transformers, PS-E-15</b>	Issue Date: <b>2007-06-25</b>	Effective Date: <b>2007-06-25</b>
	Supersedes:	

**5.1.2** NXVT electronic current transformers shall be reverified for compliance with the requirements of these specifications within a maximum of eight (8) years subsequent to the previous verification/reverification.

**5.1.3** Additional reverification testing of any NXVT which is approved conditionally shall be performed at any time as required by Measurement Canada throughout the device's period of operation in service, and such reverification shall be performed pursuant to 5.1.1.

**5.1.4** The calibration uncertainty value included within the accuracy class limit shall be less than one third of the specified accuracy class. For example, for a 0.3% class VT, the uncertainty of the calibration system including the Reference VT and Comparator shall be less than 0.1%.

## **5.2 Verification**

Verification of this device type is performed with two distinct objectives. The first is to ascertain transformer correction factor (TCF) over the operating range of the device and determine if it complies with the specified limits of error. The second is to determine metrological module characteristics as they exist at the time TCF is determined. The purpose of this second objective is to have comparative data which will be used to assess the device during subsequent reverification testing. The premise being applied at reverification is that if the characteristics of the metrological modules do not deviate more than a specified value, this is an indication that the TCF for this device type will also remain within the limits specified for verification.

### **5.2.1 Optical Wavelength of Light Source**

#### **5.2.1.1**

Wavelength shall be measured three successive times and the weighted average determined, and recorded.

#### **5.2.1.2**

The wavelength information from the original verification shall be secured and stored within the electronic chassis of the NXVT for future comparative reference during reverification.

### **5.2.2 Amplifier output**

#### **5.2.2.1**

Output voltage shall be compared to input voltage at the following three test points; 90%, 100% and 110% of the rated voltage as marked on the nameplate of the device under test.

#### **5.2.2.2**

The input voltage, output voltage, amplifier gain and phase shift shall be documented for each test point.

Category: <b>ELECTRICITY</b>	Provisional Specifications: <b>PS-E-16</b>	Page: <b>4 of 9</b>
Document(s): <b>Provisional Specification for the Approval of Electronic Voltage Transformers, PS-E-15</b>	Issue Date: <b>2007-06-25</b>	Effective Date: <b>2007-06-25</b>
	Supersedes:	

### 5.2.3 Transformer Correction Factor (TCF)

#### 5.2.3.1

TCF shall be determined with the corresponding burden for its approved accuracy class applied. Refer to Tables 1 and 2 of the Appendix.

#### 5.2.3.2

TCF shall be determined at the following three test points; 90%, 100% and 110% of the rated value of voltage as marked on the nameplate of the device under test.

#### 5.2.3.3

Measured values at each test point shall comply with the limiting values established by the parallelogram in Figure A of the Appendix for the applicable accuracy class of the device under test.

### 5.3 Reverification

The premise for reverification test criteria, as stated in section 5.2, is based on a comparative assessment of the characteristics of the metrological modules. Where the assessment determines that those measured values have remained sufficiently stable within specified limits, the device accuracy is also deemed to be within specified limits for its approved accuracy class.

In situations where any of the modules are not in compliance with the specified limits, the NXVT is deemed to be operating outside its approved accuracy class and is therefore non-compliant with the specified requirements. The NXVT shall subsequently be verified (either in-situ pursuant to section 5.4 or in a test facility pursuant to section 5.2) prior to being used to obtain the basis for a charge.

#### 5.3.1 Optical Wavelength of Light Source

##### 5.3.1.1

Wavelength shall be measured three successive times and the weighted average determined, and recorded.

##### 5.3.1.2

The weighted average wavelength determined at reverification shall not differ from wavelength determined at initial verification or any subsequent reverification by more than 0.15% (i.e.  $\pm 2$  nm) for a class 0.3 device, and not by more than 0.1% (i.e.  $\pm 1$  nm) for a class 0.15 device.

Category: <b>ELECTRICITY</b>	Provisional Specifications: <b>PS-E-16</b>	Page: <b>5 of 9</b>
Document(s): <b>Provisional Specification for the Approval of Electronic Voltage Transformers, PS-E-15</b>	Issue Date: <b>2007-06-25</b>	Effective Date: <b>2007-06-25</b>
	Supersedes:	

### **5.3.2 Amplifier Output**

#### **5.3.2.1**

Output voltage shall be compared to input voltage at the following three test points; 90%, 100% and 110% of the rated voltage as marked on the nameplate of the device under test.

#### **5.3.2.2**

The input voltage, output voltage, amplifier gain and phase shift shall be documented for each test point.

#### **5.3.2.3**

The magnitude of amplifier gain determined at reverification shall not differ from the magnitude determined at initial verification or any subsequent reverification by more than 0.15% for a class 0.3 device and not by more than 0.1% for a class 0.15 device.

#### **5.3.2.4**

The phase shift between input voltage and output voltage determined at reverification shall not differ from the phase shift determined at initial verification or any subsequent reverification by more than 6 minutes, (0.1 degrees) for a class 0.3 device and not by more than 3 minutes, (0.05 degrees) for a class 0.15 device.

### **5.4 In-situ Verification**

In-situ verification may take place only in circumstances where the NXVT has been determined to be non-compliant with the reverification requirements specified in, and pursuant to, section 5.3. In-situ verification requirements are based on the verification requirements specified in section 5.2, however have been adapted slightly such that devices which have been deemed non-compliant pursuant to section 5.3 may be eligible to be verified in-situ. Two acceptable methods for determining TCF are available.

#### **5.4.1 Optical Wavelength of Light Source and Amplifier Output**

These metrological modules shall be assessed as specified in sections section 5.2.1 and 5.2.2.

#### **5.4.2 Transformer correction factor (TCF) - Not Requiring Power Outage**

##### **5.4.2.1**

TCF shall be determined with the applied burden which is connected at the installation.

##### **5.4.2.2**

TCF shall be determined at the prevailing line voltage within the operating range of the device under test. The test points shall be between 90% and 110% of the rated value of voltage as marked on the nameplate of the device under test.

Category: <b>ELECTRICITY</b>	Provisional Specifications: <b>PS-E-16</b>	Page: <b>6 of 9</b>
Document(s): <b>Provisional Specification for the Approval of Electronic Voltage Transformers, PS-E-15</b>	Issue Date: <b>2007-06-25</b>	Effective Date: <b>2007-06-25</b>
	Supersedes:	

#### **5.4.2.3**

Measured values shall comply with the limiting values established by the parallelogram in Figure 1 of the Appendix for the applicable accuracy class of the device under test.

#### **5.4.4 Transformer Correction Factor (TCF) - Requiring Power Outage**

##### **5.4.4.1**

TCF shall be determined with the applied burden which is connected at the installation.

##### **5.4.4.2**

TCF shall be determined at any one test point between 90% and 110% of the rated value of voltage as marked on the nameplate of the device under test.

##### **5.4.4.3**

Measured values at each test point shall comply with the limiting values established by the parallelogram in Figure A of the Appendix for the applicable accuracy class of the device under test.

#### **6.0 Sealing**

**6.1** Sealing shall be performed in the manner stated in the Notice of Approval.

**6.2** It shall not be possible to modify any metrological parameters without breaching the seal(s) subsequent to the sealing of a verified NXVT.

#### **7.0 Documentation**

In addition to the certificate of verification as required pursuant to section 14 of the Electricity and Gas Inspection Act, additional verification/reverification information shall be documented and available at the installation location in order to facilitate the in-situ test provisions provided for in this specification.

The NXVT verification/reverification documentation shall include the following data for verification and each subsequent re-verification:

- (a) Wavelength values at initial verification and each subsequent reverification.
- (b) Amplifier gain values at initial verification and each subsequent reverification.
- (c) TCF (including magnitude and phase angle errors) at initial verification and each subsequent in-situ or factory verification.

Category: <b>ELECTRICITY</b>	Provisional Specifications: <b>PS-E-16</b>	Page: <b>7 of 9</b>
Document(s): <b>Provisional Specification for the Approval of Electronic Voltage Transformers, PS-E-15</b>	Issue Date: <b>2007-06-25</b>	Effective Date: <b>2007-06-25</b>
	Supersedes:	

(d) Any non-compliance with any of the requirements in these specifications, including errors exceeding specified limits.

(e) All scale factors including coarse gain, precise gain, and phase. (These shall also be stored in the electronic chassis)

(f) Serial numbers for each of the following metrological components, including all metrological components subject to individual component testing:

- i) The voltage transformer column
- ii) The electro-optics module
- iii) The amplifier(s)

(g) Maximum primary voltage rating of the device

(h) Date and location of verification/reverification

(i) Identification of standards and test equipment used

(j) Identification of the inspector or accredited meter verifier who performed the verification/reverification

Alan E. Johnston  
President

Category: <b>ELECTRICITY</b>	Provisional Specifications: <b>PS-E-16</b>	Page: <b>8 of 9</b>
Document(s): <b>Provisional Specification for the Approval of Electronic Voltage Transformers, PS-E-15</b>	Issue Date: <b>2007-06-25</b>	Effective Date: <b>2007-06-25</b>
	Supersedes:	

**Appendix - Table 1 - Burdens for Voltage Transformers with 120V Rated Secondary Output**

Standard Burden Designation / PF			Characteristics on 120 V basis		
Designation	VA	PF	Resistance $\Omega$	Inductance H	Impedance $\Omega$
Q	1	1	14400	0	14400
T	2.5	1	5760	0	5760
W	12.5	0.1	115.2	3.042	1152
X	25	0.7	403.2	1.092	576
Y	75	0.85	163.2	0.268	192
Z	200	0.85	61.2	0.101	72
ZZ	400	0.85	30.6	0.0504	36

**Note:** For lower burden classes Q and T, attention should be paid to the capacitance value of the cables. The EVT should be able to support 5 nF in parallel with the resistive burden (IEEE C37.92).

**Table 2 - Accuracy classes and corresponding limits of transformer correction factors for EVT (See Figure A)**

Accuracy Classes	Limits of Transformer Correction Factor for 90% to 110% Accuracy-Rating Voltage <sup>1</sup>		Limits of Power Factor (Lag) of Metered Power Load
	Minimum	Maximum	
<b>0.15</b>	<b>0.9985</b>	<b>1.0015</b>	<b>0.6-1.0</b>
<b>0.3</b>	<b>0.997</b>	<b>1.003</b>	<b>0.6-1.0</b>
<b>0.6</b>	<b>0.994</b>	<b>1.006</b>	<b>0.6-1.0</b>

**Notes:**

1. Only the EVTs of accuracy class 0.15, 0.3 and 0.6 may be approved for revenue metering.
2. The accuracy required for 100% rated voltages is also applicable to the rated voltage factor of the EVTs.

<sup>1</sup> These limits also apply at the maximum continuous voltage rating factor



Category: <b>ELECTRICITY</b>	Provisional Specifications: <b>PS-E-16</b>	Page: <b>9 of 9</b>
Document(s): <b>Provisional Specification for the Approval of Electronic Voltage Transformers, PS-E-15</b>	Issue Date: <b>2007-06-25</b>	Effective Date: <b>2007-06-25</b>
	Supersedes:	

**Figure A: Limits of accuracy classes for measuring voltage transformers**

