

November 2005

SPECIFICATION SS-110-TMO

DOUBLE – POLE 20KV OUTDOOR VOLTAGE TRANSFORMERS (VT's)

I. SCOPE

This hereby technical description covers PPC's requirements regarding design features, technical characteristics and testing of double – pole, outdoor, 20KV-15KV voltage transformers.

II. KEY WORDS

Voltage transformers, instrument transformers, measurement transformers.

III. STANDARDS

The voltage transformers shall conform to the latest edition of IEC 60044-2 standard.

IV. USE

The voltage transformers will be used for metering purposes, in air insulated substations.

V. OPERATING CONDITIONS

- | | |
|----------------------------------|------------------------------------|
| 1. Installation | : Outdoors |
| 2. Limits of ambient temperature | : Maximum +45 °C
Minimum -25 °C |
| 3. Altitude | : Up to 1000m above
Sea level. |
| 4. Pollution level | : Moderate |
| 5. Other climatic conditions | : Snow. Ice and fog |

VI. PPC's 20KV ELECTRIC SYSTEM CHARACTERISTICS

- | | |
|---|--|
| 1. Nominal Voltage (phase to phase) | : 20KV (unless it is specified
22 KV by the ratio) |
| 2. Maximum Operating Voltage (phase to phase) | : 24KV (1.2 x V nom) |
| 3. Nominal frequency | : 50HZ |
| 4. Short Circuit level | : 10 KA |
| 5. Basic Insulation level (Lightning Impulse) | : 150KV |
| 6. Number of phases and conductors | : 3-phase, 3-conductors, |
| 7. Earthing (grounding) Method | : Earthed neutral via a
12Ω resistor for the
20KV and 9Ω resistor
for the 15KV. |

VII. REQUIRED DESIGN FEATURES OF THE VOLTAGE TRANSFORMERS

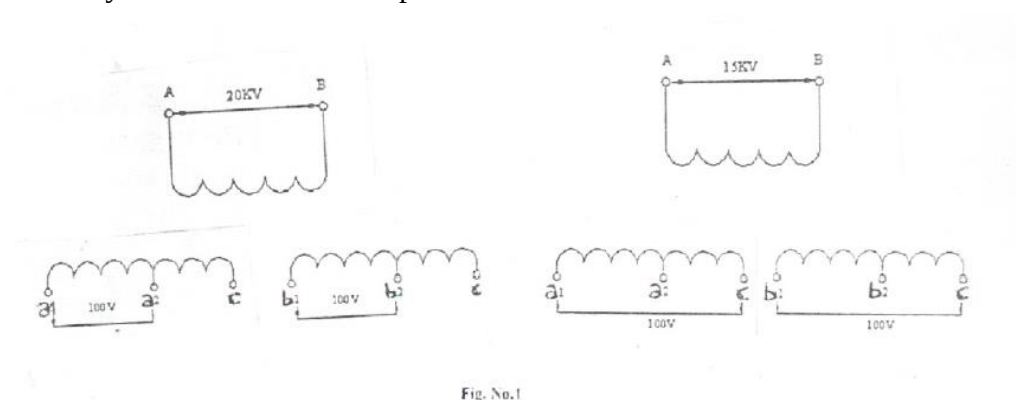
1. Type of voltage transformer

The required type will always be indicated in the inquiry and it will be one of the following two types:

- A. Voltage transformer outdoor type inductive type, oil immersed.**
The voltage transformers shall be contained in welded steel tank arranged for oil filling with its core being of high quality non aging silicon steel and shall be provided with the following accessories:
- An oil level indicator easily read from ground level.
 - A ground terminal so constructed that the earthing connections can not inadvertently be removed.
 - An oil drain and sampling plug at the bottom of the tank.
 - Lifting lugs for easy handling of the V.T.
- B. Inductive type, dry type with solid cycloaliphatic epoxy resin insulation**
suitable for outdoor installation with no additional gas and/or oil filling.
The casting shall be homogeneous for safety reasons. The secondary terminal box shall be embodied in the frame of the VT.
The base shall bear an earthing terminal for grounding purposes.

2. Required Electrical diagram of 20KV voltage transformers

Since the voltage transformer is required to have two (2) rated primary voltages, it shall be delivered with a secondary change over per instance as indicated in fig. No.1 bellow, because this arrangement guarantees high reliability in insulation and in operation.



3. Ratio

According the Requirement.

4. Connection

Phase - to - phase.

5. Secondary Winding

The VTs will be equipped with two (2) secondary winding, each one with two (2) taps (change over), as shown in Fig.No. 1. This windings will be used for metering purposes.

Its one's rated output and its accuracy class shall be according the Requirement.

6. Primary winding

The primary winding shall be suitable for 20KV and 15KV and shall have fully insulated terminals.

7. Bushings of the VTs

The voltage transformer bushings shall have the following characteristics:

- | | |
|-------------------------------------|---|
| a. Type | : Outdoor – immersed, dry or liquid filled type. |
| b. Rated voltage | : 24KV (equal with the maximum phase to phase operating voltage) |
| c. Rated phase – to – earth voltage | : 13.85KV (Maximum phase to phase operating voltage/ $\sqrt{3}$) |
| d. Creepage distance | : $\geq 600\text{mm}$ |
| e. Insulating envelope | : The insulating envelope of the bushings shall be with sheds and be of porcelain (VTs TYPE A) or cycloaliphatic epoxy resin. (VTs TYPE B). Porcelain insulating envelope shall comply with IEC – 60233 standard
“Tests on hollow insulators for electrical equipment” |

8. Insulating Oil(Applicable to type A VT)

Only mineral oil shall be used and which must be non-toxic and biodegradable. The insulating oil shall be in accordance with the latest version of IEC publication 60296, for transformer oil. The use of toxic insulating agents such as PCBs or PCT's etc is prohibited.

9. Oil – expansion bellows and sealing (Applicable to type A VT)

The VT interior shall be filled with insulating oil and the VT shall be hermetically sealed against humidity.

Any oil volume changes due to temperature fluctuations shall be accommodated by appropriate expansion of the bellows. The bellows shall be metallic and located on the VT head.

10. Primary Terminals

The primary terminals shall be of copper, cylindrical in shape with diameter of 20mm and length of about 45mm and fully insulated.

11. Secondary terminals box

a. The secondary terminals shall be located in a weatherproof hot-dip galvanized box, which must be mounted on the metallic base of the VT.

b. The terminals shall consist of threaded stubs fitted with nuts and washers. The bottom plate of the box shall be furnished without holes (undrilled) but sufficiently large so as to enable the installation of two (2) cable-gland or two (2) steel conduit. The terminal box shall also be equipped with one earthing (grounding) screw.

Terminals shall be suitable to be wired with 4mm² size conductors.

c. All secondary leads shall be protected by fuses of 2A and these fuses shall be installed inside the secondary terminal box.

12. Metal frame (case) parts

Apart from the primary terminals, all other frame metal parts shall either be of hot – dip galvanised steel or of non – corrosive metal.

13. Installation

The VT shall be suitable for installation on an outdoor steel support structure.

VIII. REQUIRED RATING CHARACTERISTICS OF THE VTs

1. Rated frequency	: 50HZ
2. Ratio	: according the Requirement
3. Rated output of secondary	: according the Requirement
4. Accuracy class	: according the Requirement
5. Minimum length of creepage path	: ≥600mm
6. Partial discharge level at 28.8KV	: ≤5pC for type “A” ≤20pC for type “B”
7. Power frequency withstand voltage for the secondary windings	: 3KV (r.m.s)
8. Rated lightning impulse withstand voltage	: 150KV peak

9. Chopped lightning impulse withstand	: 172,5 KV peak
10. Rated power – frequency withstand voltage.	: 50KV (r.m.s.)
11. Limits of the temperature rise of the windings.	: 65 ⁰ K for type «A»VT 75 ⁰ K for type «B»VT
12. Temperature category.	: -25 / +45 ⁰ C
13. Number of Secondary Windings.	: according the Requirement
14. Rated voltage factors	
a. Continuous	: 1.2
b. For 30 seconds	: 1.5

IX. TESTS

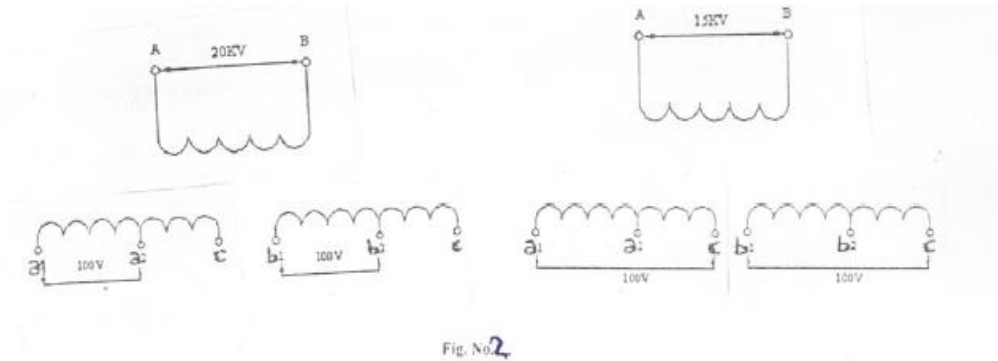
All testing shall be in accordance with IEC 60044-2 standard:

- i. Type tests
 1. Temperature rise test
 2. Short – circuit withstand capability test
 3. Lightning impulse test
 4. Wet test for outdoor type voltage transformers
 5. Determination of errors.
- ii. Routine tests
 1. Verification of terminal markings
 2. Power – frequency withstand tests on primary winding
 3. Partial discharge measurement
 4. Power – frequency withstand test on secondary windings
 5. Power – frequency withstand tests between sections of secondary windings.
 6. Determination of errors.
- iii. Special Tests (on one VT of the order)
 1. Chopped lightning impulse test

X. MARKINGS

A. Terminal markings

The terminal markings shall be per instance as indicated bellow:



B. Rating plate markings

All VT's shall bear a rating plate of non – corrosive material with the following markings:

1. The manufacture's name.
2. Serial number and type.
3. Rated primary and secondary voltage.
4. Rated frequency.
5. The rated insulation level
6. Rated output and corresponding accuracy class
7. Highest voltage.
8. Rated voltage factor and corresponding rated time.

XI. DATA TO BE SUBMITTED BY BIDDERS

1. Bidders shall supply all the technical data requested in attachment “A”, attached hereto, as well as any proposed departures from the present specification and the reason therefore. Failure on bidder's part to comply with this request will be taken as sufficient reason for rejection of the offer.
2. Technical pamphlets and brochures of the offered voltage transformers, which will help the technical evaluation process.
3. Technical data for the oil used in the voltage transformers.
4. Outline drawings showing overall dimensions of the complete VT as well as any information, sketches and data necessary for a complete description of the proposed voltage transformers.
5. Any type test certificates for the type and special tests specified in this hereby specification.
Acceptance or not of these certificates lies on the judgment of PPC S.A.

XII. DATA TO BE SUPPLIED BY THE SUCCESSFUL BIDDER

After the signing of the contract, the successful bidder shall furnish three (3) sets of drawings for approval prior to the VTs construction. The drawing shall include outline dimensional drawing, detail base drawing wiring and terminal marking drawings. The outline drawing shall include all necessary information, which will enable PPC to construct the VT's support steel structure.

XIII. PACKING

The VTs shall be packed inside robust wooden boxes, two (2) VT per box.

«ATTACHMENT A»
SPECIFICATION SS-110-TMO
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Data to provided by all bidders. Failure to comply will constitute reason for rejection of the offer.

- 1.Type and manufacture :
- 2.Ratio :
- 3.Connection :
- 4.Rated frequency :
- 5.Number of secondary windings :
- 6.Rated output and accuracy class of the
secondary windings for metering purpose:
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- 7.Temperature category :
- 8.Rated voltage factors :
- 9.Limit of temperature rise of winding :
10. For the metering purpose windings
 - a Percentage voltage (ratio) error :
 - b Phase displacement :
11. Power frequency voltage withstand of
the primary winding. :
12. Lightning impulse voltage withstand of
the primary winding :
13. Power frequency withstand voltage for
the secondary windings :
14. Partial discharges permissible level :
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15. Description of the bushings :
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16. Creepage distance of the bushings :
17. Description of the primary terminals :
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18. Description of the terminal box
of the secondary :
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19. Description of the metal frame (case)
parts :
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20. Description of sealing and of bellows
(if applicable) :
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21. Description of oil (if applicable) :
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22. Description of accessories (if applicable) :
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23. Are the terminals in the box of the
secondary of the screw type and suitable
to be wired with 4mm²size conductors? :
24. Are the secondary leads protected by
2A fuses? :
25. Are the above fuses installed inside the
Secondary terminal box? :

26. Chopped lighting impulse withstand
voltage :
27. Continuous rated voltage factor :
28. Total weight of the VT :
29. Total height of the VT :
30. Weight of oil (if applicable) :