INDEPENDENT POWER TRANSMISSION OPERATOR S.A.
NTPD/ SPECIFICATIONS & EQUIPMENT SECTOR S/S – EHV S/S

June 2011

SPECIFICATION No SS-80/4
REVISION No.4
36KV OUTDOOR INDUCTIVE TYPE VOLTAGE TRANSFORMERS

I. SCOPE

This specification covers IPTO's requirements regarding design features, rated characteristics and testing of outdoor 36KV inductive, sing1e po1e, sing1e phase oil immersed, voltage transformers for metering and protection purposes and suitable to be mounted on switchyard structures.

II. KEYWORDS

Voltage transformers, instrument transformers, measurement transformers.

III. SYSTEM CHARACTERISTICS

1. Minimal voltage	: 30KV
2. Maximum operating voltage	: 36KV
3. Rated frequency	: 50Hz
4. Earthling Method	: The 30KV system is solidly earthed only when the 30MVAR shunt reactor is energized
5. Lightning impulse level (BIL)	: 250KV peak

IV. STANDARDS

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

V. USE

The voltage transformers shall be used in conjunction with the 30KV, 50MVAR shunt reactors for metering and protection purposes

VI. SERVICE CONDITIONS

1. Limits of ambient temperature	: Maximum + 45°C Minimum - 25°C
2. Pollution level	:Moderate
3. A1titude	:Up to1000 m above sea 1eve1.
4. Other climatic conditions	: Snow, ice and fog

VII. REQUIRED DESIGN FEATURES of the VT

1.Type

Outdoor inductive type, oil immersed, single-phase with one (1) primary winding and two (2) separate secondary windings.

The design shall be either of the hair pin type with bellows or that of a flexible tank with bushings

2) Tank and Accessories.

Vo1tage transformer shall be contained in welded steel tank arranged for oil filling and shall be equipped with :

a. An oil level indicator easily read from ground level.
b. A ground (earthing) terminal so constructed that the earth connections cannot inadvertently be removed.
c. A drain valve and a filling plug
d. Lifting lugs for easy handling of the V.T.

3) Core

The core shall be made of high quality non-aging silicon steel. To avoid any ferroresonance phenomena with the capacitance of the 30 KV system, the voltage transformers shall be so designed as to operate below the knee point of its magnetizing curve even for a phase to ground voltage equal to 1.2 times the nominal system voltage, that is 1.2X30 = 36KV.

4) Windings

a. Primary : The primary winding shall be so constructed as to withstand the effect of surges and ensure uniform impulse voltage distribution throughout the winding. The primary winding shall be fully insulated.
b. Secondary : The secondary windings shall be capable of withstanding for one (1) sec the mechanical and thermal stresses resulting from a short circuit on the secondary terminals with full voltage maintained on the primary terminals.

5) Terminals.

a. The secondary terminals shall be fixed studs with clamp type connectors

inside a terminal box. The terminal box shall have a removable cover and threaded outlet for conduit connections or cable gland.
b. The primary fully insulated terminal shall be from copper or brass, cylindrical in shape, Φ30mm and of 80mm in length and.
c. The primary neutral terminal shall be of reducedd insulation and shall be either from copper or brass.

6) Bushings for the primary of the VT (if applicable)

The voltage transformer bushing shall have the following characteristics:

a. Type :Outdoor oil immersed
b. Rated voltage (neutral) : 0,72 KV for the neutral bushing
c. Rated voltage (phase) : 36 KV for the phase bushing
d. Rated phase – to-earth voltage: 21 KV for the phase bushing
e. Creepage distance (phase): ≥1300mm
f. Greapage distance (Neutral): 18mm either of porcelain or silicon rubber.
g. Insulating envelope: The insulating envelope of the bushings shall be with sheds. and be either of porcelain or silicon rubber.

7) Housing of the VT of the hair pin design and bellows (if applicable)

The housing which serves as insulator shall either be of high grade porcelain or silicon rubber.
The porcelain housing shall comply in all relevant respects with IEC-60233 ´´Tests on hollow insulators for use in electrical equipment´´.
The silicon rubber housing shall be in accordance with IEC-61462 ´´Composite insulators- Hollow insulators for use in outdoor and indoor electrical equipment´´.

8) Bellows (if applicable)

Any oil volume changes due to temperature fluctuations shall be accommodate by appropriate expansion of the bellows. The bellows shall be metallic bellows and be located at the top of VT.

9) Insulating Oil

Only mineral oil shall be used and which must be non-toxic and biodegradable.
The insulating oil shall be in accordance with the latest edition of IEC standard 60296.
The use of toxic insulating agents such as PCBs or PCTs is prohibited.

10) Secondary terminals box

The secondary terminals shall be located in a metallic weatherproof not-dip galvanized box, which must be mounted on the tank of the VT.

11) Protection of the VTs secondary windings

All secondary windings shall be protected by fuses of 6A and these fuses shall be installed inside the secondary terminals box

12) Metal frame parts

Apart from the primary terminals all other frame metal parts shall either be of not-dip galvanized steel or of non-corrosive metal.

13) Installation

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

14) Secondary Winding features

The VT will be equipped with two (2) secondary windings. One of these windings shall be used for metering purposes and the other for protection purposes. The windings shall have the following characteristics:

Metering winding

a. Rated Voltage : $100/\sqrt{3}$ V
b. Rated output : 25VA
c. Accuracy class : 0,5
d. Percentage voltage (ratio) error : ±0,5
e. Phase displacement : ±20 minutes (±0,6 centiradians)

Protection winding intended to produce residual voltage

a. Rated Voltage : 100/3V (33,3V)
b. Rated output : 10VA
c. Rated thermal limiting output : 100VA
d. Accuracy class : 6P
e. Percentage voltage (ratio) error : ±6,0
f. Phase displacement : ±240 minutes (±7,0 centiradians)

VIII REQUIRED RATING CHARACTERISTICS OF THE VT

1. Rated frequency : 50Hz

2. Ratio	: 30KV/$\sqrt{3}$ /100:$\sqrt{3}$ V-100/3V
3. Power frequency withstand voltage	: 3KV rms
4. Rated lightning impulse withstand voltage for the phase primary winding and terminal	: 250KV peak
5. Rated power frequency withstand voltage for the phase primary winding and terminal	: 95KV rms
6. Rated power frequency withstand voltage for the neutral primary winding and terminal	: 3KV rms
7. Rartial discharge level	: 5pC at 25KV
8. Chopped lightning impulse of the primary phase winding and terminal	: 287 KV peak
9. Limits of the temperature rise of the windings	: 65^{o} K
10. Temperature category	: -25^{o}C /-45^{o} C
11. Rated voltage factors	: 1,2 continuous 1,5 for 30 sec

IX. TESTS

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

A. Type Tests

1. Temperature rise test
2. Short-circuit withstand capability test
3. Lightning impulse test
4. Wet test for outdoor voltage transformers
5. Determination of errors

B. 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 winding
5. Determination of the magnetizing (excitation) curve of the VT.

Test procedure: With the secondary open- circuit, a varying voltage shall be applied on the primary and the excitation current will be measured on the primary. In case that there is no 36KV voltage available, the test can be conducted from the secondary side by applying a voltage on the secondary and measuring the current in the secondary. The primary in this case shall be open .

6. Determination of errors

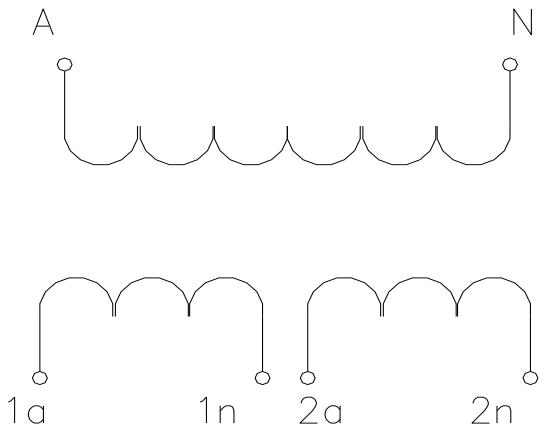
C. SPECIAL TESTS (in one (1) pcs of the order

1. Chopped waves impulse test

X. MARKINGS

A. Terminal Markings

The terminal markings shall be as indicated below:



B. Rating plate markings

All VTs shall bear a rating plate of non- corrosive material with the following markings:

1. The manufacture' 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 of the secondary windings
7. Highest voltage
8. Rated voltage factor and corresponding rated time

XI. DATA TO BE SUPPLIED BY BIDDER

1. Bidders shall provide 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 compete VT as well sa any information, sketches and data necessary for a compete 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 these certificates lies on the judgment of IPTO

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 drawings shall include outline dimensional drawing, detail base drawing, wiring and terminal marking drawings. The outline drawing shall include all necessary information, which will enable IPTO to construct the VTs support steel structure.

XIII. PACKING

The transformers shall be delivered in entirely closed and robust wooden boxes of at least 20mm thickness. The boxes will be of ΄΄pallet type΄΄, with strengthened base.
Each wooden box will include one (1) transformer and all necessary assembling material (if applicable).

XIV. WARRANTY

The Supplier must provide a warranty for ΄΄ good operation of three (3) years beginning from the date of delivery of the VTs.
In addition, a warranty of four (4) years for the bellows and the sealing of the connections between housing and metal parts must also be provided.

<< ATTACHMENT A>>
SPECIFICATION SS-80/4

36KV OUTDOOR INDUCTIVE TYPE VOLTAGE TRANSFORMER

Data to be provided by all bidders. Failure to comply will constitute reason for rejection of the offer.

1. Type and manufacture : ……..
   ……..
   ……..
   ……..
   ……..
2. Ratio : ……..
3. Rated frequency : ……..
4. Number of secondary windings : ……..
   ……

5. Is the VT of flexible tank and with bushings? : ……..

6. Is the VT of the hair pin design and bellows? : ……..

7. Is the VT equipped with the following.

a. Oil level indicator : ……..

b. Earthling (ground) terminal : ……..

c. Drain valve : ……..

d. Filling plug : ……..

e. Lifting lugs : ……..

8. Can the VT operate below the

   knee point of its magnetizing curve even at 36KV?: ……..

9. Is the primary winding fully insulated? : ……..

10. Are the secondary terminals inside

a metallic terminal box ? : ……..

11. Is the secondary terminal box hot-dip galvanized ?: ……..

12. Is the secondary terminal box

equipped with a removable cover and threaded

outlet for conduit or cable gland ? : ……..

13. Type of material and dimensions

of the primary phase (fully insulated) terminal : ……..

14. Type of material of the primary neutral terminal : ……..

15. Bushings characteristics (if applicable)

a. Type : ……..

b. Rated voltage (phase) : ……..

c. Rated voltage (Neutral) : ……..

d. Creepage distance (phase) : ……..

e. Creepage distance (Neutral) : ……..

f. Type of the insulating housing : ……..

16. Type of the insulating housing for

VT with bellows (if applicable) : ……..

17. Type of metal of the bellows : ……..

18. Description and type of the insulating oil : ……..

19. Is the insulating oil in accordance with IEC-60296 ?: ……..

20. Are the secondary windings protected by 6A fuses?: ……..

21. Are the metallic parts of the VT with the

exemption of the terminals, not-dip galvanized? : ...……..

22. Is the VT suitable to be installed on a

steel support structure? : ……..

23. Secondary windings characteristics

<u>Metering Winding</u>

a. Rated voltage : ……..

b. Rated output : ……..

c. Accuracy class : ……..

d. D. Percentage voltage error : ……..

e. Phase displacement : ……..

Protection Winding (for residual voltage)

a. Rated voltage : ……..

b. Rated output : ……..

c. Rated thermal limiting output : ……..

d. Accuracy class : ……..

e. Percentage voltage error : ……..

f. Phase displacement : ……..

24. Power frequency withstand

voltage of the secondary windings : ……..

25. Lightning impulse withstand voltage for the

phase primary winding and terminal : ……..

26. Power frequency withstand voltage

for the phase primary winding and terminal : ……..

27. Power frequency withstand voltage for

the neutral primary winding and terminal : ……..

28. Partial discharge level : ……..

29. Chopped lighting impulse withstand of

the primary phase winding and terminal : ……..

30. Limits of the temperature rise of the windings : ……..

31. Temperature category : ……..

32. Rated voltage factors

a. Continuous : ……..

b. For 30seconds : ……..

33. Total oil weight : ……..

34. Total VT weight including oil : ……..

35. Cross-section and material of the

conductor of the primary winding : ……..

36. Number of primary winding turns : ……..

37. Does the Supplier provide a warranty

according to paragr. XIV? : .....

38. Will the package of the transformers follow the

requirements of par. XIII of this hereby specification?: …….....