

**PUBLIC POWER CORPORATION S.A.  
T/NPRD/SUBSTATION & SWITCHING STATION  
SPECIFICATIONS AND EQUIPMENT SECTION**

**February 2004**

**TECHNICAL DESCRIPTION TD-52**

**VOLTAGE RELAYS  
SUPPLIED FROM VTs CONNECTED IN "BROKEN (OPEN) DELTA"  
FOR PROTECTION OF 30KV, 50 MVAR SHUNT REACTORS AGAINST  
EARTH FAULTS**

**I. SCOPE**

This hereby technical description covers PPC's requirements regarding functional features, technical characteristics and testing of voltage relays.

**II. KEYWORDS**

Voltage relays, overvoltage relays, residual voltage.

**III. STANDARDS**

The relays shall conform to IEC standards.

**IV. USE**

The voltage relays are used for the detection of earth faults for 30KV, 50MVAR shunt reactors of star (wye) connection and earthed not solidly but via VT. The input of the voltage relay will be connected to the opening of the "broken delta" which is crated by connecting the secondaries of the three VTs in "broken delta". With this way, the residual voltage is detected and as result of it, the conditions of the earth faults.

The VTs whose secondaries are connected in open delta are of ratio of  $30KV/\sqrt{3}/100/3$  V and their primaries are connected in star (wye) earthed connection.

**V. OPERATING CONDITIONS**

- |   |                                  |
|---|----------------------------------|
| 1. Installation                                 | : Indoors, inside a relay kiosk. |
| 2. Limits of ambient temperature during service | : - 10 °C to +45 °C              |
| 3. Altitude                                     | : Up to 1000 m above sea level   |

## **VI. ELECTRICAL CHARACTERISTICS OF PPC's 30 KV SYSTEM**

- |  |   |                    |
|--|---|--------------------|
| 1. Nominal Voltage (phase to phase)              | : | 30 KV              |
| 2. Maximum Operating Voltage<br>(phase to phase) | : | 36 KV              |
| 3. Number of phases                              | : | 3                  |
| 4. Nominal Frequency                             | : | 50 Hz              |
| 5. Short Circuit level                           | : | 20 KA              |
| 6. Basic Insulation level                        | : | 250 KV             |
| 7. Available auxiliary D.C. supply voltage       | : | 220 V DC $\pm$ 10% |

## **VII. REQUIRED PROTECTION FUNCTIONS SETTING CHARACTERISTICS OF THE RELAY**

The relay shall be equipped with overvoltage protection function and with the following characteristics:

- |   |   |                                 |
|---|---|---------------------------------|
| a. Setting range                                    | : | From 20 to 130 V in steps of 1V |
| b. Delay time                                       | : | 0 to 10 sec in steps of 0.1 sec |
| c. Inherent time delay to operate<br>(pick up time) | : | $\leq 50$ ms                    |
| d. Reset time                                       | : | $\leq 50$ ms                    |
| e. Reset ratio                                      | : | $\geq 95\%$                     |

## **VIII. RELAY SETTINGS**

1. The overvoltage element of the relay shall be set at a value little below of the value of 100 /3V with the time delay being set at a value of about 0,3 – 1sec.

## **IX. REQUIRED TECHNICAL CHARACTERISTICS OF THE RELAY**

- |                    |   |  |
|--------------------|---|--|
| 1. Type            | : | Numerical or digital with Input for residual voltage |
| 2. Rated frequency | : | 50 Hz  |
| 3. Setting range   | : | 20 – 130 V in steps of I V                           |

4. Rated auxiliary supply voltage : 220V DC
5. Inputs (From VTs) : The relay shall be supplied via three (3) single phase VTs with nominal ratio of  $30000/\sqrt{3}/100$  V each.  
The secondaries of the VTs are connected in “broken delta” connection and the voltage relay will be connected in the opening of the delta. Under normal operating conditions, the voltage which the voltage relay sees is zero. Under earth fault conditions, the voltage which relay sees will vary from 33.3 V to 100 V depending on the fault location.
6. Outputs contacts : At least 4 NO
7. Continuous current rating of the output contacts : 5 A
8. Current rating of the output contacts for 0.5s : 30 A
9. Switching making capacity of the output contacts at 220 V DC : 4 A
10. Switching breaking capacity of the output contacts at 220 V DC : 0.2A

#### **X. ADDITIONAL REQUIRED FEATURES OF THE RELAY**

1. The relay shall be suitable for flush panel mounting.
2. The relay terminals shall be preferably of the screw type and they must be suitable to be wired with 2.5 mm size conductors.
3. The relay shall be capable of interfacing via IEC-61850 protocol.
4. The relay shall be equipped with fault recording capability.

## **XI. TESTS**

### **A. Routine Tests**

1. Power frequency voltage withstand test :  
2 KV rms, 50 Hz, 1 minute as per IEC 60255 – 5.

### **B. Type Tests**

1. Impulse voltage withstand test :  
5KV peak, 1.2/50  $\mu$ s, 0.5 J, 3 positive and 3 negative impulses at intervals of 5 sec as per IEC 60255 – 5.
2. High Frequency test :  
2.5 KV peak, 1 MHz,  $\tau$  = 15 ms,  
400 pulses /seconds, duration = 2 sec  
as per IEC 60255 – 22 – 1, class III.
3. Fast Transient interference test :  
2 KV, 5/50 ns, 5 KHz, burst length = 15 ms,  
repetition rate = 300 ms, both polarities,  
duration = 1 min as per IEC 60255 – 22 – 4 and IEC 61000-4-4 class III.

## **XII. DATA TO BE SUBMITTED BY BIDDERS**

1. Bidders must provide all information required in “ATTACHMENT A” of this hereby technical description.  
Failure on the bidder’s part to comply with this request will be taken as sufficient reason for rejection of the offer.
2. Technical pamphlets and brochures which will help the evaluation process.
3. Outline and wiring drawings of the offered relay including mounting instructions.
4. If the offered type of voltage relay is equipped with more than one (1) inputs from VTs, then a drawing must be submitted in which the relay wiring must be indicated for the detection of the residual voltage
5. Any type test certificates for the type tests specified in this hereby technical description. Acceptance or not lies on PPC’s judgment.

## **XIII. PACKING**

The relays shall be packed inside robust paper boxes proper for this type of equipment.

**“ATTACHMENT A”**

**VOLTAGE RELAYS**  
**SUPPLIED FROM VTS CONNECTED IN BROKEN DELTA**  
**FOR PROTECTION OF 30 KV, 50MVAR STUNT REACTORS AGAINST**  
**EARTH FAULTS**

1. Type and manufacturer of the relay : .....
2. Temperature operating limits of the relay : .....
3. Is overvoltage protection function provided ? : .....
4. With regard the overvoltage function
  - a. Setting range : .....
  - b. Delay time : .....
  - c. Inherent time delay (or pick up time) : .....
  - d. Reset time : .....
  - e. Reset ratio : .....
5. Rated frequency : .....
6. Rated auxiliary supply voltage : .....
7. Is the relay suitable to be supplied from open for the detection of the residual of the voltage? : .....
8. Number of output contacts : .....
9. Continuous current rating of the output contacts. : .....
10. Current rating of the output contacts for 0,5 sec. : .....
11. Switching making capacity of the output contacts at 220 V DC. : .....
12. Switching breaking capacity of the output contacts at 220V DC : .....
13. Is the relay suitable for flush panel mounting? : .....

14. Are the relay terminals of the screw type  
and suitable to be wired with 2.5 mm<sup>2</sup>  
size conductors ? : .....
15. Power consumption of the voltage relay  
in VA at 220 V DC. : .....
16. Is the relay equipped with fault recording  
capability? : .....
17. Can the relay communicate via  
IEC-61850 protocol? : .....
18. Is the relay of the numerical or digital type? : .....
19. Weight of the relay : .....