



Inženýrsko-výrobní elektrotechnický podnik, a.s.

619 00 Brno, Vídeňská 117a, Czech Republic

(Power Engineering and Production, joint-stock company)



CZECH TESTING LABORATORIES ASSOCIATION – SDRUŽENÍ ČESKÝCH ZKUŠEBEN A LABORATORÍ



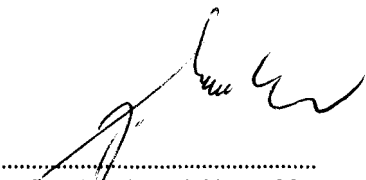
ČLEN ASOCIACE ZKUŠEBEN VYSOKÉHO NAPĚTÍ – MEMBER OF THE MV TEST LABORATORIES ASSOCIATION

TEST REPORT No.:

82-0793

Voltage Instrument Transformer of Outdoor Design,
Type VPT 25




Dipl.-Ing. Jaromír Mudra, CSc.

Brno, on: Sept. 10, 2001

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IVEP, a.s.

Vídeňská 117a

Test shops and Laboratories CZ 619 00 Brno, Czech Republic

Phone: +42 5 47136650, + 42 5 47136690

Telefax: + 42 5 47136402

<http://www.ivep.cz>

e-mail: zkusebna@ivep.cz



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Tested device: Voltage Instrument Transformer
of Outdoor Design

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Type:

VPT 25

Kind of test:

partial test

Testing carried out in accordance with the
following standards and regulations:
ČSN 35 1302

Rated values :

Highest voltage for equipment
 $U_m = 25 \text{ kV AC}$

Test ordered by:

KPB INTRA, s.r.o.
Fučíkova 860
685 01 Bučovice, Czech Republic

Order number:

KPB o 201/0479, as of Sept. 07, 2001

Tested sample registration numbers:

217/01 to 219/01
prod. No. KPB 007922, 007923 a 007927

Atmospheric conditions:

Air temperature: 21,0°C
Air pressure: 1019.8 hPa
Air humidity: 52% (100%)

Manufacturer of the products:

KPB INTRA, s.r.o.
Fučíkova 860
685 01 Bučovice

The test rep. includes:

Text pages: 7
Tables:
Diagrammes:
Drawings:
Photographs:
Appendices:

Distribution list:

IVEP ŘZ - 1x
KPB - 2x
IVEP-archives: 1x

The samples for testing were delivered on:

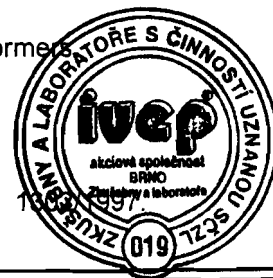
Sept. 03, 2001

Test result:

The outdoor design, VPT 25 type, double-pole insulated voltage transformer
manufactured by the company KPB INTRA, s.r.o.

have passed

the requirements of insulation tests using impulse and AC voltage to ČSN 35 1302



Date of the test:

Sept. 05 and 06, 2001

Testing engineer:

Dipl.-Ing. Jaromír Mudra, CSc.,

Manager of the test laboratory:

Dipl.-Ing. Jaromír Mudra, CSc.



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1. Introduction

During the period of Sept. 05 to 06, 2001, tests of insulation using impulse and AC test voltage were carried out on 3 pcs of outdoor design, VPT 25 type voltage instrument transformers at the MV test laboratory of IVEP a.s., based on the test order No. 201/04794 issued by the company KPB INTRA, s.r.o.

2. Description of the tested instrument transformers

The VPT 25 type voltage instrument transformers are double-pole insulated devices, embedded in epoxy resin, with one primary and one secondary windings.

2.1. Transformer nameplate data

Type VTP 25, manufactured by the company KPB INTRA s.r.o., ratio 22000/100 V; 25/50/125 kV, prod. year 2001; 500 VA, 50 Hz; to ČSN 35 1302
prod. No. 007922 – reg. No. 217/01
prod. No. 007923 – reg. No. 218/01
prod. No. 007929 – reg. No. 219/01

3. Testing devices used during the test

Impulse generator 1.2 MV; Haefely; 1.2/50 μ s, 30 kJ; in a setup for 400 kV; inventory No. 00376/1
Two-beam impulse oscilloscope Haefely; type 72 E; inventory No. 00376/9
Impulse peak-to-peak V-meter Haefely; type 64 M; inventory No. 00932
Transformer cascade 500 kV; 150 kVA; Siemens; inventory No. 00077
Capacitive voltage divider 600 kV Haefely with peak-to-peak V-meters Trüb-Täuber, inventory No. 00038
Artificial rain equipment IVEP; jets of 0.5 mm dia; impact angle of 45° to 90° (to ČSN IEC 60-1)
AC power source up to 5 kV, STS Opava, inventory No. 00536
Motorgenerator MEZ. 220 V, 200 Hz; 74 A; inventory No. 00123

4. Scope of the insulation tests

The standard ČSN 35 1302 specifies the following insulation tests to be carried out on outdoor voltage instrument transformers to be used in systems with the highest voltage of $U_m = 25$ kV:

4.1 Test of primary winding using impulse voltage of 1.2/50 μ s to the stipulations of the ČSN 35 1302 standard, section 13.2., appendix No. NA2, table III.A. In this test the transformer is subjected to the effects of 15 positive and 15 negative lightning impulses of a peak value of 125 kV. The test voltage is first applied to the A terminal while the B, b and PE terminals are earthed, the a terminal is insulated from the earth and then the voltage is applied to the B terminal while the A, a and PE terminals are earthed, and the b terminal is insulated from the earth.

4.2 Test of primary winding using dry AC test voltage to ČSN 35 1302, section 16, appendix No. NA2, table III A, with one-minute short-time AC withstand voltage of 50 kV (rms value).

4.2.1. Test using the applied voltage

The test voltage of $\sim U_s = 50$ kV/50 Hz (rms value) is applied for 1 minute to the mutually interconnected terminals A, B; the a, b and PE terminals and the transformer frame are earthed.

4.2.2. Test of interturn insulation

The testing voltage of $\sim U_s = 50$ kV/200 Hz (rms value) is applied for 30 seconds first to the A terminal whilst the B, b and PE terminals are earthed, and the a terminal is insulated from the earth. Thereafter the test voltage is applied to the B terminal, in the same way as in the previous case, and the A, a and PE terminals as well as the frame are earthed; the b terminal being insulated from the earth.

4.3 Insulation tests of the secondary winding, to ČSN 35 1302, section 17, using one-minute short-time AC withstand voltage of 3 kV/50 Hz (rms value), with insulated primary terminals A and B. The test voltage is applied to:



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4.3.1. the secondary terminal a; the second secondary terminal b along with the primary terminals A, B is insulated, and the PE terminal with the frame are earthed;

4.3.2. the secondary terminal b; the second secondary terminal a along with the primary terminals A, B is insulated, and the PE terminal with the frame are earthed.

4.4 Test of outer insulation using AC voltage, in wet conditions (under rain), to the ČSN 35 1302 standard, section 14, appendix NA2, table III A, and to IEC 60-1, section 8.1,

4.4.1. one-minute short time AC withstand voltage of 50 kV/50 Hz (rms value). The test voltage is applied to the interconnected primary terminals A and B. All other terminals of the secondary winding and the frame are earthed.

4.4.2. short-time AC withstand voltage of 50 kV/200 Hz/30 s (rms value)
The test voltage is applied to:

4.4.2.1. the primary terminal A; the B, b and PE terminals as well as the frame are earthed; the a terminal is insulated from the earth;

4.4.2.2. the primary terminal B. The A, a and PE terminals along with the frame are earthed, the b terminal is insulated from the earth.

4.5. Informative tests based on the customer wish

4.5.1. Informative test of outer insulation, using increased level of AC test voltage of 75 kV/50 Hz, in rainy conditions.

4.5.2. Informative test of flashover impulse voltage in rainy conditions.

4.5.3. Verification of the withstand AC test voltage on transformer insulation, in rainy conditions.

The symbols used in the report:

$\sim U_m$ - highest voltage for equipment (rms value)

+U, -U – rated withstand voltage of the 1,2/50 μ s lightning impulse wave, of both positive and negative polarity (peak value). The writing 15/0 means 15 impulses applied to the tested device, without flashover and with satisfactory result.

$\sim U_s$ – rated short-time AC withstand voltage (rms value), in dry conditions; 50 Hz (200 Hz)

$\sim U_d$ – rated short-time AC withstand voltage, applied in conditions of artificial rain; 200 Hz (rms value)

$\sim U_i$ - short-time AC power frequency voltage of 3kV/50 Hz/1 minute (rms value)

+ U_p , - U_p , $\sim U_p$ – break-through or flashover voltage

$\sim U_{vd}$ – withstand AC voltage under rain

5. The test results

5.1 The VPT 25 Voltage Instrument Transformer

U_m = 25 kV; production number 007922; registration number 217/01; to ČSN 35 1302; transformer ratio 22000/100 V, 25/50/125 kV, 500 VA, production year 2001

5.1.1. Test of primary winding using impulse voltage

5.1.1.1. The A terminal is connected with the test voltage, the B, b, PE terminals and the frame are earthed, the a terminal is insulated from the earth.

+U = 125 kV/15 impulses/0

- test result: satisfactory

5.1.1.2 The B terminal is connected with the test voltage, the A, a, PE terminals and the frame are earthed, the b terminal is insulated from the earth.

+U = 125 kV/15 impulses/0

- test result: satisfactory



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5.1.1.3. The A terminal is connected to the test voltage, the B, b, PE terminals as well as the frame are earthed, the a terminal is insulated from the earth.

- $U = 125 \text{ kV/15 impulses/0}$

- test result: satisfactory

5.1.1.4 The B terminal is connected to the test voltage, the A, a, PE terminals and the frame are earthed, the b terminal is insulated from the earth.

- $U = 125 \text{ kV/15 impulses/0}$

- test result: satisfactory

5.1.2. Test of primary winding using AC test voltage, in dry conditions

5.1.2.1. Test using test voltage applied to the interconnected A and B terminals; the a, b and PE terminals as well as the frame are earthed.

$\sim U_s = 50 \text{ kV/50 Hz/ 1 minute}$

- test result: satisfactory

5.1.2.2. Interturn insulation test

5.1.2.2.1. The A terminal is connected to the test voltage, the B, b, PE terminals and the frame are earthed, the a terminal is insulated from the earth.

$\sim U_s = 50 \text{ kV/200 Hz/30 sec.}$

- test result: satisfactory

5.1.2.2.2. The B terminal is connected to the test voltage, the A, a, PE terminals and the frame are earthed, the b terminal is insulated from the earth.

$\sim U_s = 50 \text{ kV/200 Hz/30 sec.}$

- test result: satisfactory

5.1.3. Insulation tests of the secondary winding

5.1.3.1. The a terminal is connected to the test voltage, the PE terminal and the frame are earthed, the A, B and b terminals are insulated from the earth.

$\sim U_i = 3,0 \text{ kV/50 Hz/1 minute}$

- test result: satisfactory

5.1.3.2. The b terminal is connected to the test voltage, the PE terminal and the frame are earthed, the A, B and a terminals are insulated from the earth.

$\sim U_i = 3,0 \text{ kV/50 Hz/1 minute}$

- test result: satisfactory

5.1.4. Test of outer insulation using AC test voltage under rainy conditions

5.1.4.1. The test voltage is applied to interconnected terminals A and B; the a, b and PE terminals as well as the frame are earthed.

$\sim U_d = 50 \text{ kV/50 Hz/1 minute}$

- test result: satisfactory

5.1.4.2. The A terminal is connected to the test voltage, the B, b and PE terminals as well as the frame are earthed, the a terminal is insulated from the earth.

$\sim U_d = 50 \text{ kV/200 Hz/30 sec.}$

- test result: satisfactory

5.1.4.3. The B terminal is connected to the test voltage, the A, a and PE terminals and the frame are earthed, the b terminal is insulated from the earth.

$\sim U_d = 50 \text{ kV/200 Hz/30 sec.}$

- test result: satisfactory

5.2. The VPT 25 voltage instrument transformer

$U_m = 25 \text{ kV}$, production number 007923, reg.No. 218/01, to ČSN 35 1302, transformer ratio of 22000/100 V; 25/50/125 kV, 500 A; production year 2001

5.2.1. Test of impulse voltage applied on primary winding

5.2.1.1. The A terminal is connected to the test voltage, the B, b, PE terminals and the frame are earthed, the a terminal is insulated from the earth.

$+U = 125 \text{ kV/15 impulses/0}$

- test result: satisfactory

5.2.1.2 The B terminal is connected to the test voltage, the A, a, PE terminals and the frame are earthed, the b terminal is insulated from the earth.



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5.2.1.3. The A terminal is connected to the test voltage, the B, b, PE terminal and the frame are earthed, the a terminal is insulated from the earth.

- $U = 125 \text{ kV/15 impulses/0}$

- test result: satisfactory

5.2.1.4 The B terminal is connected to the test voltage, the A, a, PE terminals and the frame are earthed, the b terminal is insulated from the earth.

- $U = 125 \text{ kV/15 impulses/0}$

- test result: satisfactory

5.2.2. Test of primary winding using AC test voltage in dry conditions

5.2.2.1. Test using test voltage applied to the interconnected A and B terminals; the a, b and PE terminals as well as the frame are earthed.

$\sim U_s = 50 \text{ kV/50 Hz/ 1 minute}$

- test result: satisfactory

5.2.2.2. Inter-turn insulation test

5.2.2.2.1. The A terminal is connected to the test voltage, the B, b, PE terminals and the frame are earthed, the a terminal is insulated from the earth.

$\sim U_s = 50 \text{ kV/200 Hz/30 sec.}$

- test result: satisfactory

5.2.2.2.2. The B terminal is connected to the test voltage, the A, a, PE terminals and the frame are earthed, the b terminal is insulated from the earth.

$\sim U_s = 50 \text{ kV/200 Hz/30 sec.}$

- test result: satisfactory

5.2.3. Insulation tests of the secondary winding

5.2.3.1. The a terminal is connected to the test voltage, the PE terminal and the frame are earthed, the A, B and b terminals are insulated from the earth.

$\sim U_i = 3,0 \text{ kV/50 Hz/1 minute}$

- test result: satisfactory

5.2.3.2. The b terminal is connected to the test voltage, the PE terminal and the frame are earthed, the A, B and a terminals are insulated from the earth.

$\sim U_i = 3,0 \text{ kV/50 Hz/1 minute}$

- test result: satisfactory

5.2.4. Test of outer insulation using AC test voltage, under rainy conditions

5.2.4.1. The test voltage is applied to interconnected terminals A and B; the a, b and PE terminals as well as the frame are earthed.

$\sim U_d = 50 \text{ kV/50 Hz/1 minute}$

- test result: satisfactory

5.2.4.2. The A terminal is connected to the test voltage, the B, b and PE terminals as well as the frame are earthed, the a terminal is insulated from the earth.

$\sim U_d = 50 \text{ kV/200 Hz/30 sec.}$

- test result: satisfactory

5.2.4.3. The B terminal is connected to the test voltage, the A, a and PE terminals and the frame are earthed, the b terminal is insulated from the earth.

$\sim U_d = 50 \text{ kV/200 Hz/30 sec.}$

- test result: satisfactory

5.3. The VPT 25 voltage instrument transformer

$U_m = 25 \text{ kV}$, production number 007927, registration number 219/01; to ČSN 35 1302; transformer ratio 22000/100 V; 25/50/125 kV, 500 A, production year 2001

5.3.1. Test of primary winding using impulse test voltage

5.3.1.1. The A terminal is connected to the test voltage, the B, b, PE terminals and the frame are earthed, the a terminal is insulated from the earth.

$+U = 125 \text{ kV/15 impulses/0}$

- test result: satisfactory



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5.3.1.2 The B terminal is connected to the test voltage, the A, a, PE terminals and the frame are earthed, the b terminal is insulated from the earth.

+ U = 125 kV/15 impulses/0

- test result: satisfactory

5.3.1.3. The A terminal is connected to the test voltage, the B, b, PE terminals as well as the frame are earthed, the a terminal is insulated from the earth.

- U = 125 kV/15 impulses/0

- test result: satisfactory

5.3.1.4 The B terminal is connected to the test voltage, the A, a, PE terminals and the frame are earthed, the b terminal is insulated from the earth.

- U = 125 kV/15 impulses/0

- test result: satisfactory

5.3.2. Test of primary winding using AC test voltage, in dry conditions

5.3.2.1. Test using test voltage applied to the interconnected A and B terminals; the a, b and PE terminals as well as the frame are earthed.

~ U_s = 50 kV/50 Hz/ 1 minute

- test result: satisfactory

5.3.2.2. Interturn insulation test

5.3.2.2.1. The A terminal is connected to the test voltage, the B, b, PE terminals and the frame are earthed, the a terminal is insulated from the earth.

~ U_s = 50 kV/200 Hz/30 sec.

- test result: satisfactory

5.3.2.2.2. The B terminal is connected to the test voltage, the A, a, PE terminals and the frame are earthed, the b terminal is insulated from the earth.

~ U_s = 50 kV/200 Hz/30 sec.

- test result: satisfactory

5.3.3. Insulation tests of the secondary winding

5.3.3.1. The a terminal is connected to the test voltage, the PE terminal and the frame are earthed, the A, B and b terminals are insulated from the earth.

~ U_i = 3,0 kV/50 Hz/1 minute

- test result: satisfactory

5.3.3.2. The b terminal is connected to the test voltage, the PE terminal and the frame are earthed, the A, B and a terminals are insulated from the earth.

~ U_i = 3,0 kV/50 Hz/1 minute

- test result: satisfactory

5.3.4. Test of outer insulation using AC test voltage under rainy conditions

5.3.4.1. The test voltage is applied to interconnected terminals A and B; the a, b and PE terminals as well as the frame are earthed.

~ U_d = 50 kV/50 Hz/1 minute

- test result: satisfactory

5.3.4.2. The A terminal is connected to the test voltage, the B, b and PE terminals as well as the frame are earthed, the a terminal is insulated from the earth.

~ U_d = 50 kV/200 Hz/30 sec.

- test result: satisfactory

5.3.4.3. The B terminal is connected to the test voltage, the A, a and PE terminals and the frame are earthed, the b terminal is insulated from the earth.

~ U_d = 50 kV/200 Hz/30 sec.

- test result: satisfactory

5.4. Informative tests according to the customer's wish

5.4.1. Informative test of the transformer outer insulation using increased level of AC test voltage. The test voltage was being gradually increased to up to 75 kV/50 Hz.

The test voltage was applied to the A terminal, the B, b and PE terminals and the frame were earthed, the a terminal was insulated from the earth.

~ U_d = 0 to 75 kV/50 Hz/- creeping discharges in between the A and B terminals.



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5.4.2. Informative test of flashover impulse voltage in rainy conditions, by gradually increased peak-value voltage by $\Delta U = 4 \text{ kV}$

The test voltage was applied to the A terminal, the B, b and PE terminals as well as the frame were earthed, the a terminal was insulated from the earth.

5.4.2.1. test sample registration number: 217/01, production number: 007922

+ $U = 125$ to 164.4 kV – without flashover

+ $U_p = 168.1 \text{ kV}$ – flashover along the surface in between the A and B outlets.

5.4.2.2. test sample registration number: 218/01, production number: 007923

+ $U = 125$ to 156.1 kV – without flashover

+ $U_p = 158,9 \text{ kV}$ – flashover along the surface, in between the ribs of the A and B outlets.

5.4.2.3. test sample registration number: 219/01, production number: 007927

+ $U = 125$ to 160.0 kV – without flashover

+ $U_p = 163,8 \text{ kV}$ – flashover along the surface, in between the A and B outlets.

5.4.3. Verification of the withstand level of AC test voltage on the outer insulation, in rainy conditions

The test voltage was applied to the interconnected A and B terminals, the a, b, PE terminals as well as the frame were earthed.

$\sim U_{vd} = 70 \text{ kV/50 Hz/1 minute}$

- test result: satisfactory

6. Conclusion, summary

The VPT 25 voltage instrument transformers of outdoor design, manufactured by the company KPB INTRA, s.r.o., production numbers 007922, 007923 and 007927 **have passed** the impulse and AC voltage tests to ČSN 35 1302/1997.

10. IX. 2001