Inženýrsko-výrobní elektrotechnický podnik, a.s.
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MEASURING TRANSFORMERS LABORATORY

TEST PROTOCOL No. 73 – 0047/04

VTS 25 Voltage Measuring Transformers

(laboratory stamp)

(signature)
Ing. Rada Vlastimil
Measuring transformers laboratory manager
IVEP a.s.

In Brno on 15 March 2005

Changes and amendments in this protocol can be done only in measuring transformers laboratory of IVEP a.s.

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ivep®	**Test protocol No.** 73 – 0047/04 **Test subject:** VTS 25 Voltage Measuring Transformers	**Page:** 1 **Number of pages:** 4

Type: VTS 25	**Test type:** Type test
Rated values: Highest voltage for equipment 25 kV Serial number 010580 Rated transfer 22000/√3 // 100/√3 / 100/ √3 V Rated load 50 VA 30 VA Accuracy class 0.5 0.5 Serial number 012938 Rated transfer 22000/√3 // 100/√3 / 100/ √3 V Rated load 50 VA 100 VA Accuracy class 0.5 6P Extreme load 500 VA Rated frequency 50 Hz Isolation class E	**Tested according to:** CSN EN 60044-2 IEC 60044-2 CSN 351302 IEC 186 CSN 351360 **Test customer:** KPB INTRA s.r.o. Zdanska 477 685 01 Bucovice
Serial Number: 010580, 012938	**Atmospheric conditions:** Temperature: °C Pressure: hPa Air humidity: %
Products manufacturer: KPB INTRA s.r.o. Zdanska 477 685 01 Bucovice	**Samples delivered on:** 2002 - 2004

Test result:

VTS 25 voltage measuring transformers, producer KPB INTRA s.r.o.,
in design 3.6, 7.2, 12, 17.5, and 25 kV

comply

with the type test conditions pursuant to CSN EN 60044-2, IEC 60044-2, CSN 351302, IEC 186, and CSN 351360.

(laboratory stamp)

Test date: 6/2002 - 4/2004	Tested by: Ing. Vlastimil Rada (signature) Ing. Maskova Hana (signature)	Chief: Ing. Vlastimil Rada (signature)

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In the laboratory of measuring transformers of IVEP, a.s., tests using alternate voltage of secondary windings, measuring of partial discharges for the insulation level of 25 kV, and measuring of accuracy with two depending secondary windings according to standards CSN 35 1302, CSN EN 60044-2, and IEC 60044-2 were performed on two pieces of voltage measuring transformers of type VTS 25, for purpose of expansion of the Decision of type approval No. 2656/97/010. Further tests and measuring at the prototypes of VTS 25 were performed according to standards CSN 35 1360 and IEC 186 in conditions that are identical with the requirements of the aforementioned standards.

Test Results

1. Test using alternate voltage of secondary winding
The test was performed using alternate voltage of 3 kV/50 Hz for a period of 1 minute between these parts of the transformer:
a) Insulation between the primary and secondary winding
b) Insulation between the secondary windings
c) Insulation between the secondary windings and the earthed skeleton

The measuring transformer of voltage type VTS 25 complies with CSN EN 60044-2 Art. 9.3, IEC 60044-2 Art. 9.3, and CSN 35 1302 Art. 17.

2. Measuring of partial discharges
The measuring was performed at the voltage transformer type VTS 25, s.no. 012938 for the highest system voltage U_m=25 kV according to method B.
These values were measured:

1.2 U_m (30 kV)	Q= 15 pC
1.2 U_m / √3 (17.3 kV)	Q=4 pC

The results of measuring at prototypes of VTS 25 (design 12 kV) according to IEC 186 are stated in protocol of IVEP a.s. No. 80-13896.
The measured values of partial discharges at the measuring transformer of voltage VTS 25 complied with the requirements of standards CSN EN 60044-2 Art. 9.2.4, IEC 60044-2 Art. 9.2.4, and CSN 35 1302 Art. 16.1 for both types of grid grounding.

3. Accuracy test
The test was performed at the measuring transformer of voltage of type VTS 25 s.no. 010580 with two depending secondary windings with rated loads of 50 and 30 VA using the differential method and equipment by Tettex for verification of measuring transformers of voltage type 2765, s.no. 136 176 - Calibration 817-KL-0028-03.
During measuring, the following was also used:
High voltage divider system producer Tettex-Calibration sheet no. 817-KL-0018-03
Voltage load, producer Tettex - type 3683/KS - Calibration sheet no. 817-KL-653-4/00
Voltage load, producer Hartmann & Braunn - type NBKv - Verification sheet no. 817/057/99
The measured values of voltage and angle errors within the range of 80, 100, and 120 % U_N are stated in the following Table No. 1

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Table of Measured Values No. 1

Serial No.	Errors	Rated primary voltage %			Load [VA] cos β = 0.8	
		80	100	120	1a-1n	2a-2n
010580	ε_U [%]	+ 0.33	+ 0.33	+ 0.34	12.5	0
	δ_U [‘]	+ 0.58	+ 0.58	+ 0.62		
	ε_U [%]	+ 0.09	+ 0.09	+ 0.09	12.5	30
	δ_U [‘]	-1.63	-1.65	-1.64		
	ε_U [%]	-0.19	-0.19	-0.19	50	0
	δ_U [‘]	+ 1.95	+ 1.94	+ 2.00		
	ε_U [%]	-0.43	-0.43	-0.43	50	30
	δ_U [‘]	-0.24	-0.27	-0.24		
	ε_U [%]	+ 0.40	+ 0.41	+ 0.41	0	7.5
	δ_U [‘]	+ 0.74	+ 0.73	+ 0.78		
	ε_U [%]	+ 0.01	+ 0.01	+ 0.01	50	7.5
	δ_U [‘]	-2.99	-3.04	-3.04		
	ε_U [%]	+ 0.09	+ 0.09	+ 0.09	0	30
	δ_U [‘]	+ 2.98	+ 2.57	+ 2.64		
	ε_U [%]	-0.30	-0.30	-0.30	50	30
	δ_U [‘]	-1.15	-1.18	-1.19		

The measuring transformer of voltage type VTS 25 with two mutually depending windings complied with the accuracy test pursuant to standards CSN EN 60044-2 Art. 12.2, IEC 60044-2 Art. 12.2, and CSN 35 1302 Art. 25. Other combinations of accuracy classes (including accuracy classes for securing 3P and 6P) and rated loads when verifying the voltage measuring transformers must comply with the requirements of TPM 2272-99.
Measuring of accuracy at the prototypes of measuring transformers of voltage VTS 25 with measuring windings in combination with windings for indication of ground connection is stated in protocol IVEP a.s. No. 83-0116.
From the aforementioned measuring, these ranges of rated secondary loads result, provided the thread correction at the measuring winding is performed:

1. One measuring winding
   5 VA - 30 VA - accuracy class 0.2
   5 VA - 100 VA - accuracy class 0.5, 1, 3 (3P and 6P)

2. One measuring winding + auxiliary windings in accuracy class 6P
   5 VA - 30 VA in accuracy class 0.2
   5 VA - 100 VA - accuracy class 0.5, 1, 3 (3P and 6P)

3. Two depending measuring windings + (auxiliary winding in accuracy class 6P)
   5 VA -15 VA in accuracy class 0.2 + 5 VA -15 VA in accuracy class 0.2 (0.5; 1; 3; 3P; 6P)
   5 VA -15 VA in accuracy class 0.2 + 5 VA -15 VA in accuracy class 0.2 (0.5; 1; 3; 3P; 6P)+ auxiliary winding
   5 VA - 50 VA in accuracy class 0.5 + 5 VA - 50 VA in accuracy class 0.5(1, 3P, 6P) + auxiliary winding

The voltage measuring transformers type VTS 25 complies with the conditions of standards CSN EN 60044-2 Art. 12.2, IEC 60044-2 Art. 12.2, and CSN 35 1302 Art. 25.

Further tests that were performed at the prototypes of measuring transformers of voltage VTS 25 according to standards CSN 35 1360 and IEC 186 are in their performance identical to standards CSN EN 60044-2, IEC 60044-2, and CSN 35 1302.

4. Terminal designation correctness check
The designation of primary and secondary terminals of voltage measuring transformers VTS 25 complies with CSN EN 60044-2 Art. 11.2, IEC 60044-2 Art. 11.2, and CSN 35 1302 Art. 21.

5. Atmospheric impulse test
Measuring transformers of voltage type VTS 25 complied with standards CSN EN 60044-2 Art. 8.3.2, IEC 60044-2 Art. 8.3.2 and CSN 35 1302 Art. 13.2. see protocol IVEP a.s. No. 82-0567.

6. Alternate voltage of primary winding test
Measuring transformers of voltage type VTS 25 complied with standards CSN EN 60044-2 Art. 9.2.2.1, IEC 60044-2 Art. 9.2.2.1, and CSN 35 1320 Art. 16.2.1. see protocol IVEP a.s. No. 82-0567 and 80-12896.

7. Heating test
From measured values of heating of measuring transformers of voltage type VTS 25 in design 12 - 25 kV that are stated in protocols of IVEP a.s. No. 83-0116 and No. 80-12896 results:
The extreme load of measuring winding 1a-1n and 2a-2n - 500 VA
The extreme rated load of auxiliary winding da-dn - 100 VA
Total secondary load of measuring windings must not exceed 100 VA.
Total secondary load of auxiliary winding must not exceed 100 VA.
Measuring transformers of voltage VTS 25 complied during the heating test for insulation class E with standards CSN EN 60044-2 Art. 5.4, IEC 60044-2 Art. 5.4, and CSN 35 1302 Art. 8.

8. Short circuit resistance test
The measuring transformers of voltage type VTS 25 complied with standards CSN EN 60044-2 Art. 8.2, IEC 60044-2 Art. 8.2, and CSN 35 1302 Art. 12, see protocol of IVEP a.s. No. 88-0122.