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

TEST PROTOCOL No. 73 – 0055/05

CTS 25 Current Measuring Transformers

(laboratory stamp)

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

In Brno on 8 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 – 0053/05 **Test subject:** CTS 25 Current Measuring Transformers	**Page:** 1 **Number of pages:** 5

Type: CTS 25	**Test type:** Type test
Rated values: Highest voltage for equipment 25 kV Serial number 009908 Rated transfer 5 // 5/5A Rated load 10 VA; 15 VA Accuracy class 0.5 ; 10P Serial number 012942 Rated transfer 150 - 300 // 5/5A Rated load 15 VA; 15 VA Accuracy class 0.5 ; 5P Serial number 022265 Rated transfer 1 600 // 5/5A Rated load 15 VA; 15 VA Accuracy class 0.2S ; 0.5S Rated frequency 50 Hz Isolation class E	**Tested according to:** CSN EN 60044-1 IEC 60044-1 CSN 35 1301 IEC 185 CSN 35 1360 **Test customer:** KPB INTRA s.r.o. Zdanska 477 685 01 Bucovice
Serial Number: 009908, 012942, 022265	**Atmospheric conditions:** Temperature: °C Pressure: hPa Air humidity: %
Products manufacturer: KPB INTRA s.r.o. Zdanska 477 685 01 Bucovice	**Samples delivered on:** 2002 - 2005

Test result:

CTS 25 current measuring transformers, producer KPB INTRA s.r.o.,

comply

with the type test conditions pursuant to CSN EN 60044-1, IEC 60044-1, CSN 35 1301, IEC 185, and CSN 35 1360.

(laboratory stamp)

Test date: 6/2002 - 2/2005	Tested by: Ing. Vlastimil Rada (signature) Ing. Maskova Hana (signature)	Chief: Ing. Vlastimil Rada (signature)

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In the short circuit testing station and the laboratory of measuring transformers of IVEP, a.s., a type test according to standards CSN EN 60044-1, IEC 60044-1, and CSN 35 1301 was performed on three pieces of current measuring transformers of type CTS 25, for purpose of expansion of the Decision of type approval No. 2416/96/1 with rated primary current 5 A, accuracy classes 0.2S, 0.5S, and the expanded current range of 200 %.

The type test was performed in this scope:

1. Terminal designation correctness check
The measuring transformers of current type CTS 25 complied with CSN EN 60044-1 Art. 8.1., IEC 60044-1 Art. 8.1, and CSN 35 1301 Art. 16.

2. Industrial frequency alternate voltage primary winding test
The test was performed in the laboratory of measuring transformers of IVEP, a.s. with test voltage 50 kV / 50 Hz for a period of 1 minute at measuring transformer of current s. no. 009908 and 012942.
The test results of other prototypes from the type series CTS 25 that were performed according to CSN 35 1360 and IEC 185 are stated in the test protocol of IVEP, a.s. No. 82-0495.
The measuring transformer of current type CTS 25 complied with CSN EN 60044-1 Art. 8.2, IEC 60044-1 Art. 8.2, and CSN 35 1301 Art. 17.

3. Test using alternate voltage of secondary winding
The test was performed in the measuring transformer laboratory of IVEP, a.s. using alternate voltage of 3 kV/50 Hz for a period of 1 minute between the shorted secondary terminals and the transformer parts grounded in operation.
The measuring transformers of current type CTS 25 complied with CSN EN 60044-1 Art. 8.3, IEC 60044-1 Art. 8.3, and CSN 35 1301 Art. 18.

4. Measuring of partial discharges
The measuring was performed at the measuring transformers of current s. no. 009908 and 012942 in the measuring transformer laboratory of IVEP, a.s. according to the test procedure Method – B – stated in CSN EN 60044-1 Art. 8.2. These values of partial discharges were measured:

Serial No.	Test voltage:	Partial discharge amplitude value	Note
009908	$U_{zk} = 1.2\ U_m = 30$ kV	q = 5 pC	Complies
	$U_{zk} = 1.2 / \sqrt{3}\ U_m = 17.3$ kV	q = 2 pC	Complies
012942	$U_{zk} = 1.2\ U_m = 30$ kV	q = 45 pC	Complies
	$U_{zk} = 1.2 / \sqrt{3}\ U_m = 17.3$ kV	q = 0.5 pC	Complies

Further results of measuring of partial discharges at the prototypes of type series CTS 25 are stated in the type protocol of IVEP a.s. No. 80-12849 and No. 82-0495.

The measuring transformers of current type CTS 25 complied with CSN EN 60044-1 Art. 8.2, IEC 60044-1 Art. 8.2, and CSN 35 1301 Art. 17 for both types of grounding in HV grids.

5. Short circuit test
The test was performed in the short circuit testing station of IVEP a.s. at the prototype of measuring transformer of current type CTS 25 s. no. 009908 with rated primary current 5 A - see the test protocol No. 88-0257.
The results of the short circuit tests of other prototypes from the type series of CTS 25 performed in the short circuit testing stations of IVEP a.s. and Bechovice are stated in the test protocol of IVEP a.s. No. 88-0086 and the test record from the short circuit testing station Bechovice No. 96-079.
The measuring transformers of current type CTS 25 complied with CSN EN 60044-1 Art. 7.1, IEC 60044-1 Art. 7.1, and CSN 35 1301 Art. 12.

6. Heating test
The test was performed at the measuring transformers of current type CTS 25 s. no. 012942 (transfer 150-300//5/5 A) and s. no. 022265 (transfer 1 600//5/5 A) with the rated permanent thermal current ext. 200 %. The secondary windings of both measuring transformers of current were loaded with rated burdens of 15 VA with power factor cos β = 1.

The heating of secondary windings was measured by the change of ohmic resistance. Heating of primary terminals P1 and P2 was measured using thermocouples.
These heating values were measured:

		Serial number 022965	Serial number 012942	
Primary winding	P1	61K	P1	60K
	P2	60K	P2	59K
Secondary winding	1S1-1S3	58K	1S1-1S2	69.5K
	2S1-2S3	57K	2S1-2S2	70.4K

Measuring transformers of current CTS 25 complied with CSN EN 60044-1 Art. 7.2, IEC 60044-1 Art. 7.2, and CSN 35 1301 Art. 13 for insulation class E.

7. Error Measuring

The measuring was performed using the differential method and equipment by Tettex for verification of current measuring transformers type 2761, s.no. 136'127 - Calibration sheet no. 8017-KL-0061-04.
During measuring, the following was also used:
Current measuring transformer - comparator Tettex type 4764, s.no. 135'233 - Calibration sheet no. 132-KL-1048-03
Current load Tettex type 3671/KK, s. no. 135'897 - Calibration sheet no. 817-KL-653-3/00
The measured values of current and angle errors are stated in the following table No. 1.

Table of measured values No. 1

Serial number	Errors	Rated primary current %					Load [VA]
		1	5	20	100	120	
009908 1S1-1S2	ε_i [%]	+ 0.42	+ 0.37	+ 0.41	+ 0.41	+ 0.41	2.5
	δ_i [‘]	+ 6.83	+ 6.90	+ 5.72	+ 3.08	+ 2.81	
	ε_i [%]	-0.06	-0.06	+ 0.04	+ 0.16	+ 0.17	10
	δ_i [‘]	+ 10.33	+ 7.70	+ 1.74	-3.20	-3.28	
009908 2S1-2S2	ε_i [%]				-0.48		15
	δ_i [‘]				-3.36		
After short circuit test							
009908 1S1-1S2	ε_i [%]	+ 0.42	+ 0.37	+ 0.41	+ 0.41	+ 0.41	2.5
	δ_i [‘]	+ 6.83	+ 6.60	+ 5.17	+ 2.76	+ 2.52	
	ε_i [%]	-0.06	0	+ 0.04	+ 0.17	+ 0.18	10
	δ_i [‘]	+ 10.33	+ 6.67	+ 1.61	-3.35	-3.60	
009908 2S1-2S2	ε_i [%]				-0.53		15
	δ_i [‘]				-4.87		
Serial number	Errors	Rated primary current %					Load [VA]
		1	5	20	100	200	
012942 1S1-1S2	ε_i [%]	-0.25	+ 0.14	+ 0.20	+ 0.22	+ 0.23	3.75
	δ_i [‘]	+ 27.27	+ 9.63	+ 6.35	+ 4.39	+ 3.72	
	ε_i [%]	-0.99	-0.49	-0.33	-0.18	-0.12	15
	δ_i [‘]	+ 8.86	+ 4.03	+ 0.37	-3.38	-5.05	

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Serial number	Errors	Rated primary current %					Load [VA]
		1	5	20	100	200	
012942 1S1-1S3	ε_i [%]	+ 0.08	+ 0.15	+ 0.17	+ 0.18	+ 0.18	3.75
	δ_i [‘]	+ 9.75	+ 4.68	+ 2.92	+ 2.20	+ 2.01	
	ε_i [%]	-0.34	-0.01	+ 0.04	+ 0.07	+ 0.08	15
	δ_i [‘]	+ 8.53	+ 2.71	+ 1.36	+ 0.58	+ 0.16	
012942 2S1-2S2	ε_i [%]				-0.33		15
	δ_i [‘]				+ 2.77		
012942 2S1-2S3	ε_i [%]				+ 0.11		15
	δ_i [‘]				+ 0.91		
022265	ε_i [%]	+ 0.10	+ 0.14	+ 0.14	+ 0.15	+ 0.14	3.75
	δ_i [‘]	+ 3.00	+ 2.00	+ 2.00	+ 1.80	+ 1.50	
	ε_i [%]	0	+ 0.08	+ 0.11	+ 0.12	+ 0.11	15
	δ_i [‘]	+ 3.50	+ 2.50	+ 2.00	+ 1.40	+ 2.00	

From the aforementioned measuring and the measuring of accuracy performed at the prototypes of measuring transformers of current type CTS 25 - see protocol of IVEP, a.s. No. 80-12849, these basic measuring parameters result:
Primary I_N range 5 - 3 200 A
Secondary I_N 1 and 5 A
Number of measuring windings 1 - 3
Accuracy classes: 0.2, 0.2S, 0.5, 0.5S, 1, 3
Number of securing windings 1 - 2
Accuracy classes 5P, 10P
Rated secondary loads depending on the size of primary ampere threads and the required accuracy classes are within the range of 2.5 - 60 VA.

All combinations of rated secondary loads and accuracy classes must comply with the requirements of TPM 2272-99 when verifying the measuring transformers of current of accuracy classes 0.2, 0.2S, 0.5, 0.5S.
For other accuracy classes and measuring and securing windings, the provisions of corresponding standards apply.
The rated expanded primary current - 200 % of the rated primary current.
The maximal rated permanent thermal primary current is 3 200 A.

The current measuring transformers type CTS 25 complied with CSN EN 60044-1 Art. 11, 12.3, IEC 60044-1 Art. 11, 12.3, and CSN 35 1301 Art. 26, 37.

Further tests that were performed at the prototypes of type CTS 25 according to standards CSN 35 1360 and IEC 185 are in their performance identical to standards CSN EN 60044-1, IEC 60044-1, and CSN 35 1301.

8. Thread insulation test
The test was performed at the prototypes of measuring transformers of current type CTS 25 and their results are stated in the test protocol of IVEP, a.s. No. 80-12849.
The measuring transformers of current type CTS 25 complied with CSN EN 60044-1 Art. 8.4, IEC 60044-1 Art. 8.4, and CSN 35 1301 Art. 19.

9. Instrument security factor and overall error measuring
The results of the measuring at the prototypes of measuring transformers of current type CTS 25 are stated in the test protocol of IVEP, a.s. No. 80-12849.
The measuring transformers of current type CTS 25 complied with CSN EN 60044-1 Art. 11.6 and 12.5, IEC 60044-1 Art. 11.6, 12.5, and CSN 35 1301 Art. 31 and 40.

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10. Atmospheric impulse primary winding test

The test was performed on measuring transformer of current type CTS 25 with 15 impulses of positive and negative polarity using test voltage +/- 125 kV.
The test results are stated in the protocol of IVEP, a.s. No. 82-0495.
Measuring transformers of current type CTS 25 complied with CSN EN 60044-12 Art. 7.3.2, IEC 60044-1 Art. 7.3.2, and CSN 35 1301 Art. 14.