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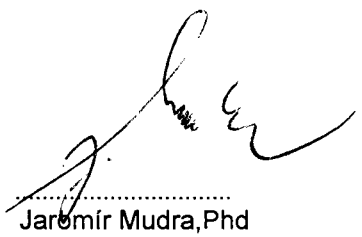
REPORT OF PERFORMANCE No: 80-12849

SUPPORTING TYPE INSTRUMENT CURRENT TRANSFOMERS TYPE CTS12, CTS25



Jaromír Mudra,Phd

Brno, Dec. 22 1998

ivep®	**TEST REPORT** No: 80 - 12849 Tested subject: Supporting Type Instrument Current Transformers	Page No.:1 Number of pages: 14

TYPE: CTS 12 CTS 25	KIND OF TEST: type test TESTING ACC. TO: ČSN 35 1360 IEC 185/1987 Appendix 2 to IEC 185-1995-08
RATED VALUES: Rated primary current 10-3200 A Rated secondary current 5A or 10A Highest voltage of the system: 12 kV; 25 kV Accuracy class: 0.2; 0.5 5P; 10 P Security factor: < 5 Testing voltage: 35/75 kV 55/125 kV Rated frequency: 50 Hz Insulation class: E	TEST REQUEST ISSUED BY: The Czech Metrology Institute Okružní 31 638 00 Brno ORDER NUMBER: Contract No. 13/Tr. of 01/1996 TESTED SPECIMEN REG. NUMBER: 148/96 to 153/96 ENVIRONMENTAL CONDITIONS: TEMPERATURE: ATMOSPHERIC PRESSURE: AIR HUMIDITY:

PRODUCT MANUFACTURER KPB Intra, s.r.o. Fučíkova 860 685 01 Bučovice	THIS TEST REPORT INCLUDES: TEXT PAGES: 13 TABLES: 8 OSCILLOGRAMMES: DIAGRAMMES: DRAWINGS: PHOTOS:	DISTRIBUTION LIST: Client 2x IVEP Archives 1x IVEP ŘT 2x
TESTED SPECIMENS DELIVERED ON: May, 1996		

TEST RESULT:

The supporting type, instrument current transformers of CTS 12 and the CTS 25 types

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with the type test requirements according to the ČSN 35 1360 and IEC 185 standards, the Appendix No. 2 to the IEC 185-1995-08 standard, for current range from 10A to 3200 A.

DATE OF TEST:	TEST PERFORMED BY:	MANAGER OF TEST LAB.
June to July 1996	Vlastimil Rada	[illegible] Mudra, PhD.

EVIDOVANÁ VE SDRUŽENÍ ČESKÝCH ZKUŠEBEN ZKUŠEBNA ivep akciová společnost BRNO Zkušebny a laboratoře 019

On the basis of the Contract No. 13/Tr. 01/1996, concerning the performance of metrology measurement to be conducted by the ČMI Prague, the type tests on instrument current transformers of CTS 12 and CTS 25 type, manufactured by KPB INTRA, s.r.o. Bučovice, were carried through at the IVEP State Testing Metrology Centre, conformably to the ČSN 35 1360 standard, to the IEC Publication No. 185 and the Appendix No. 2 to the IEC 185-1995-08.
The transformers were manufactured in conformity with the drawing numbers T 12001, T 12002, T 25001 and the winding procedures No. 4 120001 to 4 120003, 4 250001, 4 250002, 4 250004. The tests were conducted at the IVEP State Metrology Centre, the IVEP short-circuit test shop and the Běchovice short-circuit testing station.

The following products were subject of the type testing:

CTS 12.L transformer - sample No. 148/96 - prod. No. 1200001
20//5/1 A; 10 VA; accuracy class 0.5 - n < 5
15 VA; accuracy class 10P - n = 5

CTS 12.S transformer - sample No. 149/96 - prod. No. 1200002
200-400//5/5 A; 15 VA; accuracy class 0.2 - n < 5
15 VA; accuracy class 5P - n = 10

CTS 12.S transformer - sample No. 150/96 - prod. No. 1200003
3200//5/1 A; 60 VA; accuraca class 0.2 - n < 5
60 VA; accuracy class 5P - n = 5

CTS 25 transformer - sample No. 151/96 - prod. No. 2500001
10//1/5 A; 10 VA; accuracy class 0.5 - n < 5
15 VA; accuracy class 10P - n = 5

CTS 25 transformer - sample No. 152/96 - prod. No. 2500002
400-800//5/5 A; 15 VA; accuracy class 0.5 - n < 5
15 VA; accuracy class 5P - n = 20

CTS 25 transformer - sample No. 153/96 - prod. No. 2500004
1000//5/5 A; 20 VA; accuracy class 0.5 - n < 5
20 VA; accuracy class 5P - n = 10

Scope of the type test:

1. Verification of proper marking of transformer terminals
2. Measurement of transformer accuracy
3. Measurement of the rated security factor (FS) and the composite error
4. Impulse test
5. Power frequency withstand test
6. Test of interturn insulation
7. Partial discharge measurement
8. Temperature-rise test
9. Short-circuit test
10. Checking of the transformer workmanship and equipment completeness

1. Verification of a correct marking of transformer terminals

Polarity check of the primary and secondary winding was performed during the accuracy measurement, by using the polarity indication instrument. The transformers comply with the ČSN 35 1360 requirements, Article No. 120.

2. Measurement of transformer accuracy

The transformer accuracy was verified by using the compensation method, by means of the Hartmann Braun AG measuring bridge of Keller system, MEWK type, production number 6406857 of the instrument, verification sheet No. LPM/451/93.

Additionally the following measuring instruments were used:

Instrument current transformer - comparator; manufactured by Tettex, 4767 type, prod. No. 135233, verification sheet No. CM114/1/078/95

Instrument current transformer - manufactured by Tettex, 4724 type, prod. No. 113033, verification sheet No. CM 114/1/128/95

Current burden: manufactured by Hartman & Braun AG, NBKa type, production No. 3154031, verification sheet No. LPM/451/93

Current burden: manufactured by IVEP a.s. Brno. This burden is an inherent part of the abover current burden No. 3154031; verification sheet No. 250 - tr/04/92

The accuracy measurement was performed in conformity with the ČSN 35 1360 standard, Article No. 61 and 71, and with the IEC 185 standard, Article No. 27 and 37.
The values of current error and that of the phase displacement, before and after the short-circuit test, are given in the following tables.

Table No. 1 - Instrument current transformer of CTS 12.L type,
No. of tested sample 148/96
transformer ratio 20//5/1 A; 10 VA; accuracy class 0.5
" 15 VA; accuracy class 10P

	I_N	5%	10%	20%	100%	120%	P_N VA
winding 1S1-1S2	I[%]	+0.34	+0.33	+0.32	+0.32	+0.32	2.5
	I[']	+16.2	+14.5	+11.9	+5.1	+5.1	
	I[%]	-0.49	-0.40	-0.31	-0.01	0.00	10
	I[']	+21.0	+13.9	+7.9	-3.0	-3.1	
after short-circuit test	I[%]	+0.35	+0.33	+0.32	+0.32	+0.32	2.5
	I[']	+16.0	+14.1	+11.8	+5.0	+4.5	
	I[%]	-0.46	-0.38	-0.29	0.00	0.00	10
	I[']	+20.0	+13.0	+7.0	-3.5	-3.0	
winding 2S1-2S2	I[%]				+0.87		7.5
	I[']				+6.5		
	I[%]				+0.30		15
	I[']				+3.0		
after short-circuit test	I[%]				+0.83		7.5
	I[']				+6.9		
	I[%]				+0.25		15
	I[']				+3.0		

Table No. 2 - Instrument current transformer of CTS 12.S type,
No. of tested sample 149/96
transformer ratio 200-400//5/5 A; 10 VA; accuracy class 0.2
" 15 VA; accuracy class 5P

	I_N	5%	10%	20%	100%	120%	P_N VA
winding 1S1-1S2 200//5/5A	I [%]	+0.13	+0.13	+0.12	+0.11	+0.11	3.75
	I [']	+7.1	+6.5	+6.0	+4.2	+4.5	
	I [%]	-0.19	-0.15	-0.12	-0.04	-0.05	15
	I [']	+10.8	+8.0	+5.0	+2.5	+3.5	
after short-circuit test	I [%]	+0.12	+0.12	+0.12	+0.11	+0.12	3.75
	I [']	+6.8	+5.9	+5.0	+4.1	+2.0	
	I [%]	-0.13	-0.12	-0.09	-0.03	-0.02	15
	I [']	+8.1	+6.2	+4.1	+1.5	+1.2	
winding 2S1-2S2	I [%]				-0.32		7.5
	I [']				+5.9		
	I [%]				-0.46		15
	I [']				+5.0		
winding 1S1-1S2 400//5/5A	I [%]	+0.12	+0.12	+0.12	+0.11	+0.11	3.75
	I [']	+6.9	+6.5	+5.9	+4.0	+3.9	
	I [%]	-0.16	-0.16	-0.13	-0.03	-0.02	15
	I [']	+10.0	+8.1	+5.8	+2.0	+1.1	
winding 2S1-2S2 400//5/5A	I [%]				-0.32		7.5
	I [']				+5.9		
	I [%]				-0.47		15
	I [']				+5.0		

Table No. 3 - Instrument current transformer of CTS 12.S type,
No. of tested sample 150/96
transformer ratio 3200//5/5 A; 60 VA; accuracy class 0.2
" 60 VA; accuracy class 5P

	I_N	5%	10%	20%	100%	120%	P_N VA
winding 1S1-1S2	I[%]	-0.02	+0.01	+0.03	+0.05	+0.07	15
	I[']	+8.0	+5.8	+4.0	+2.0	+1.1	
	I[%]	-0.29	-0.21	-0.14	-0.05	-0.02	60
	I[']	+10.0	+6.5	+3.6	+2.0	0.0	
after short-circuit test	I[%]	-0.03	-0.01	+0.02	+0.04	+0.06	15
	I[']	+8.9	+6.8	+4.0	+2.1	+1.9	
	I[%]	-0.30	-0.23	-0.15	-0.05	-0.04	60
	I[']	+10.9	+7.0	+3.9	+1.9	+0.9	
winding 2S1-2S2	I[%]				+0.24		30
	I[']				+0.5		
	I[%]				+0.18		60
	I[']				-0.5		
after short-e circuit test	I[%]				+0.22		30
	I[']				+2.0		
	I[%]				+0.15		60
	I[']				0.0		

Table No. 4 - Instrument current transformer of CTS 25 type,
No. of tested sample 151/96
transformer ratio 10//1/5 A; 10 VA; accuracy class 0.5
" 15 VA; accuracy class 10P

	I_N	5%	10%	20%	100%	120%	P_N VA
winding 1S1-1S2	I [%]	+0.51	+0.50	+0.48	+0.47	+0.47	2.5
	I [']	+20.9	+17.0	+14.2	+7.2	+6.9	
	I [%]	-0.67	-0.46	-0.35	+0.04	+0.03	10
	I [']	+35.5	+24.0	+17.0	+1.9	+2.0	
after short-circuit test	I [%]	+0.51	+0.49	+0.48	+0.47	+0.47	2.5
	I [']	+19.5	+17.0	+14.0	+7.5	+7.0	
	I [%]	-0.59	-0.44	-0.33	+0.04	+0.05	10
	I [']	+30.9	+23.0	+15.9	+0.5	+1.1	
winding 2S1-2S2	I [%]				-0.82		7.5
	I [']				+12.5		
	I [%]				-1.25		15
	I [']				+11.5		
after short-circuit test	I [%]				-0.81		7.5
	I [']				+11.9		
	I [%]				-1.24		15
	I [']				+11.0		

Table No. 5 - Instrument current transformer of CTS 25 type, .
No. of tested sample 152/96
transformer ratio 400-800//5/5 A; 15 VA; accuracy class 0.5
" 15 VA; accuracy class 5P

	I_N	5%	10%	20%	100%	120%	P_N VA
winding 1S1-1S2 400//5/5A	I [%]	-0.05	-0.04	-0.05	-0.05	-0.05	3.75
	I [']	+5.8	+5.0	+4.0	+2.1	+2.0	
	I [%]	-0.21	-0.19	-0.17	-0.12	-0.12	15
	I [']	+7.9	+5.9	+4.0	+1.1	+1.1	
winding 2S1-2S2 400//5/5A	I [%]				-0.09		7.5
	I [']				+2.0		
	I [%]				-0.13		15
	I [']				+2.1		
winding 1S1-1S2 800//5/5A	I [%]	-0.03	-0.03	-0.04	-0.04	-0.05	3.75
	I [']	+5.0	+4.5	+3.8	+1.9	+1.5	
	I [%]	-0.22	-0.21	-0.18	-0.12	-0.10	15
	I [']	+8.5	+7.1	+4.9	+0.8	0.0	
after short-circuit test	I [%]	-0.04	-0.04	-0.04	-0.05	-0.06	3.75
	I [']	+5.5	+5.0	+4.0	+2.1	+1.3	
	I [%]	-0.20	-0.19	-0.17	-0.12	-0.11	15
	I [']	+7.9	+6.1	+3.9	+1.1	+0.5	
winding 2S1-2S2 800//5/5A	I [%]				-0.09		7.5
	I [']				+2.1		
	I [%]				-0.10		15
	I [']				+2.1		
after short-circuit test	I [%]				-0.09		7.5
	I [']				+2.1		
	I [%]				-0.13		15
	I [']				+2.1		

Table No. 6 - Instrument current transformer of CTS 25 type,
No. of tested sample 153/96
transformer ratio 1000//5/5 A; 20 VA; accuracy class 0.5
" 20 VA; accuracy class 5P

	I_N	5%	10%	20%	100%	120%	P_N VA
winding 1S1-1S2	$_I$[%]	+0.15	+0.20	+0.24	+0.30	+0.31	5
	$_I$[']	+9.2	+7.5	+5.5	+2.1	+2.1	
	$_I$[%]	-0.30	-0.22	-0.12	+0.06	+0.08	20
	$_I$[']	+12.2	+9.2	+6.0	0.0	-0.3	
winding 2S1-2S2	$_I$[%]				+0.43		10
	$_I$[']				+1.5		
	$_I$[%]				+0.39		20
	$_I$[']				+1.8		

The instrument current transformers of CTS 12 and CTS 25 types, the sample numbers 148/96 to 153/96 comply with the requirements of ČSN 35 1360 and IEC 185 standards. The measured current and phase displacement errors, measured before and after the short-circuit test, correspond with accuracy class indication on the transformer nameplate.

3. Measurement of the rated security factor (FS) and the composite error

This measurement was performed in accordance with the indirect method, as described by the ČSN 35 1360 standard, Article No. 107b; 108e and by the IEC 185 Publication, Articles No. 31 and 39b.
The respective values of instrument security factor and the composite error are given in tables 7 or 8, respectively.

Table No. 7

Type	Sample number	Secondary winding ratio	Burden	Security factor to ČSN 35 1360	IEC 185
CTS 12.L	148/96	20//5/1 A 1S1-1S2	10 VA	2.56	2.15
CTS 12.S	149/96	200-400//5/5 A 1S1-1S2	15 VA	2.87	2.45
CTS 12.S	150/96	3200//5/1 A 1S1-1S2	60 VA	3.1	2.55
CTS 25	151/96	10//1/5 A 1S1-1S2	10 VA	2.21	1.96
CTS 25	152/96	400-800//5/5 A 1S1-1S2	15 VA	2.64	2.10
CTS 25	153/96	1000//5/5 A 1S1-1S2	20 VA	4.12	3.40

Table No.8

Type	Sample number	Secondary winding ratio	Burden	Security factor	Composite error
CTS 12.L	148/96	20//5/1 A 2S1-2S2	15 VA	5	1.40%
CTS 12.S	149/96	200-400//5/5 A 2S1-2S2	15 VA	10	0.94%
CTS 12.S	150/96	3200//5/1 A 2S1-2S2	60 VA	5	0.10%
CTS 25	151/96	10//1/5 A 2S1-2S2	15 VA	5	0.88%
CTS 25	152/96	400-800//5/5 A 2S1-2S2	15 VA	20	5.0%
CTS 25	153/96	1000//5/5 A 2S1-2S2	20 VA	10	0.01%

The instrument current transformers of CTS 12 and CTS 25 types, the sample numbers 148/96 to 153/96 comply with the requirements of ČSN 35 1360 and IEC 185 standards. The instrument security factor values and the composite errors correspond with data shown on the transformer rating plate.

4. Impulse test

This test was performed in accordance with the ČSN 35 1360 standard, Article No. 110, and with IEC 185 Publication, Clause 14.
The tested samples No. 148/96 to 150/96, of the CTS 12 type series, passed the test by 15 positive and 15 negative 75 kV impulses, without a flashover.
The tested samples No. 151/96 to 153/96, of the CTS 25 type series, passed the test by 15 positive and 15 negative 125 kV impulses, without a flashover.

Detailed description and the test resuls are given in the IVEP Brno test report No. 82 - 0495.

5. Power frequency withstand test

a) Power frequency test between the primary and the secondary winding.

This test was performed conformably to the ČSN 35 1360 standard, Article No. 112, and the IEC 185 Publication, Clause 17, by using the testing AC voltage of 35 kV/1 minute (on testing sample numbers 148/96 to 150/6 of the CTS 12 series) and by using the testing AC voltage of 55 kV/1 minute (on testing sample numbers 151/96 to 153/96 of the CTS 25 series), with a satisfactory result. The description and the test results are given in the IVEP Brno 82-0495 test report.

b) Power frequency test on secondary windings

This test was performed by means of the testing power supply device, registration number 00770, by using a 3 kV AC testing voltage applied during 1 minute between the terminals of each secondary winding, and between each of the secondary windings and earthed parts.
The tested samples of sample numbers 148/96 to 153/96, of the CTS 12 and CTS 25 type series, did pass the test with satisfactory result.
Tested specimens No. 148/9 to 152/96 exposed to a short-circuit test at the IVEP Brno and Běchovice testing stations, were repeatedly subjected to the above power frequency test, with test voltage levels reduced to 90 per cent of the rated value. The tested specimens of the CTS 12 and CTS 25 did comply with the ČSN 35 1360, Art. 116h and the IEC 185, Clause 12c requirements.

6. Test of interturn insulation

The specimens No. 148/96 to 149/96; 151/96 to 153/96, and the 150/96 (with 1S1 - 1S2 secondary winding) were subjected to the interturn insulation test with 120 % rated primary current, and the 150/96 specimen (with 2S1 - 2S2 secondary winding) to a test voltage of č.5 kV_{max}, during a time period of 1 minute.
The testing voltage on the open-end secondary winding was measured by means of a peak voltmeter with SME 2 capacitive divider. The CTS 12 and CTS 25 type, instrument current transformers passed the ČSN 35 1360, Art. 144 requirements, and that of the Appendix No. 2 of IEC 185-1995-08 Publication, by using the "A" testing procedure.
The specimens No. 148/96 to 152/96 did comply with the ČSN 35 1360, Art. 116h, and the IEC 185 Publication, Clause 12c requirements on a repeated interturn insulation test with reduced test voltage level (because of a previous short-circuit test carried out at the IVEP Brno and Běchovice test stations).

7. Partial discharge measurement

This kind of measurement was performed conformably to the Appendix No. 2 of IEC-1995-08 Publication, for both network earthing modes. The test results are given in the IVEP Brno test report No. 82-0495.
The values of partial discharges, measured on the instrument current transformers of CTS 12 and CTS 25 type, comply with the prescribed values for the highest operated voltages of U_m = 12 kV and U_m = 25 kV, in both the impedance earthed and the effectively-earthed neutral systems.
After carrying through the short-circuit tests at the IVEP Brno and Běchovice testing stations the following partial discharge values were measured:

Specimen No. 148/96 - CTS 12.L - prod. No. 1200001
1.2 U_m - Q = 2pC = satisfactory result
1.2 $U_m/\sqrt{3}$ - Q = 0.6pC = satisfactory result

Specimen No. 149/96 - CTS 12.S - prod. No. 1200002
1.2 U_m - Q = 1pC = satisfactory result
1.2 $U_m/\sqrt{3}$ - Q = 0.6pC = satisfactory result

Specimen No. 150/96 - CTS 12.S - prod. No. 1200003
1.2 U_m - Q = 40 pC = satisfactory result
1.2 $U_m/\sqrt{3}$ - Q = 0.5pC = satisfactory result

Specimen No. 151/96 - CTS 25 - prod. No. 2500001
1.2 U_m - Q = 2pC = satisfactory result
1.2 $U_m/\sqrt{3}$ - Q = 0.5pC = satisfactory result

Specimen No. 152/96 - CTS 25 - prod. No. 2500002
1.2 U_m - Q = 1.5pC = satisfactory result
1.2 $U_m/\sqrt{3}$ - Q = 0.5pC = satisfactory result

8. Temperature rise test

This test was performed on specimens No. 148/96; CTS 12.L; 20//5/1 A and No. 152/96; CTS 25; 400-800//5/5A, with the test current of 120 % of rated value and the 15 VA rated secondary burden.

The temperature rise was measured by using the method of resistance increase in the secondary winding. The temperature of primary windings was measured by the "Thermophil" electronic temperature meter. At an average, test-site ambient temperature of 23°C the following temperature rise and winding temperatures were identified:

Specimen No. 148/96 - CTS 12.L
temp. rise 1S1 - 1S2 - 5.9 K
2S1 - 2S2 - 6.5 K
Primary winding temperature = 28°C

Specimen No. 152/96 - CTS 25
temp. rise 1S1 - 1S2 -23.6 K
2S1 - 2S2 -24.6 K
Primary winding temperature = 55°C

The values of temperature rise and the temperature values comply with the ŠN 35 1360, Art. 39, and IEC 185, Clause 9 and 13 requirements for the "E" insulation Class.

9. Short-circuit test

This test was performed on specimens No. 148/96 to 22//5/1 A; 149/95 to 200-400//5/5 A; 151/96 to 10//1/5 A, and carried out at the IVEP Brno short-circuit testing station (see the test report No. 88-0086).

Additionally, the specimens No. 150/96 to 3200//5/1A; 152/96 to 400-800//5/5 A were subject to a short-circuit test at the Běchovice testing station (see the test report No. 96-079).

Based on the repeated accuracy measurement, the repeated insulation tests of primary and secondary windings, the partial discharge test and the visual inspection of the transformer body after passing the short-circuit test, the test results to ČSN 35 1360, Art. 116 and IEC 185, Clause 12 requirements may be considered to be satisfactory.

8. Temperature rise test

This test was performed on specimens No. 148/96; CTS 12.L; 20//5/1 A and No. 152/96; CTS 25; 400-800//5/5A, with the test current of 120 % of rated value and the 15 VA rated secondary burden.

The temperature rise was measured by using the method of resistance increase in the secondary winding. The temperature of primary windings was measured by the "Thermophil" electronic temperature meter. At an average, test-site ambient temperature of 23°C the following temperature rise and winding temperatures were identified:

Specimen No. 148/96 - CTS 12.L
temp. rise 1S1 - 1S2 - 5.9 K
2S1 - 2S2 - 6.5 K
Primary winding temperature = 28°C

Specimen No. 152/96 - CTS 25
temp. rise 1S1 - 1S2 -23.6 K
2S1 - 2S2 -24.6 K
Primary winding temperature = 55°C

The values of temperature rise and the temperature values comply with the ŠN 35 1360, Art. 39, and IEC 185, Clause 9 and 13 requirements for the "E" insulation Class.

9. Short-circuit test

This test was performed on specimens No. 148/96 to 22//5/1 A; 149/95 to 200-400//5/5 A; 151/96 to 10//1/5 A, and carried out at the IVEP Brno short-circuit testing station (see the test report No. 88-0086).

Additionally, the specimens No. 150/96 to 3200//5/1A; 152/96 to 400-800//5/5 A were subject to a short-circuit test at the Běchovice testing station (see the test report No. 96-079).

Based on the repeated accuracy measurement, the repeated insulation tests of primary and secondary windings, the partial discharge test and the visual inspection of the transformer body after passing the short-circuit test, the test results to ČSN 35 1360, Art. 116 and IEC 185, Clause 12 requirements may be considered to be satisfactory.