

**Test Object :** Voltage instrument transformers for indoor use

**Type :** VTD 12

**Ratings:**

Design: cast resin insulated for indoor use			
Serial number:		030582	027913
Rated primary voltage	[ V ]	6000	10500
Rated voltage of secondary winding (a- n)	[ V ]	230	100
Rated voltage of secondary winding (da-dn)	[ V ]	---	---
Rated output of secondary winding (a- n)	[ VA ]	400	60
Accuracy class of secondary winding (a- n)		3	0,5
Rated output of secondary winding (da-dn)	[ VA ]	---	---
Accuracy class of secondary winding (da-dn)		---	---
Highest voltage for equipment Um	[ kV ]	7,2	12
Power frequency withstand voltage	[ kV ]	20 (32)	28 (42)
Lightning-impulse (chopped) withstand voltage	[ kV ]	60 (70)	75 (90)
Rated frequency	[ Hz ]	50	50
Thermal limiting output	[ VA ]	400	400

**Manufacturer:** KPB Intra s.r.o, BUČOVICE

**Test performed :** Dielectric tests: Lightning impulse test on primary winding  
Power - frequency withstand test on primary winding  
PD measurement

**Test specification :** GOST 1516.3-96, GOST 1983 - 2001  
KPB Intra s.r.o, order Nr. 003000124/2007

**Test results :** The transformers VTD 12, serial number 030582 and 027913 have been tested in accordance with GOST 1516.3-96 and GOST 1983-2001. Transformers are considered to comply with the above standards.

**Date of test :** 13. 2. 2007

13.2.2007

**Date of issue**

**Test manager**

**Laboratory manager**

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- The transformers VTD 12, serial number 030582 and 027913 have been subjected to the dielectric tests in compliance with Standard GOST 1516.3-96, GOST 1983 – 2001 for voltage classes:
- 6 kV (Highest voltage for equipment  $U_m = 7,2$  kV) and
- 10 kV (Highest voltage for equipment  $U_m = 12$  kV)

#### TEST PROGRAM:

#### Standard

- |   |                                    |
|---|------------------------------------|
| 1. Verification of terminal markings                    | GOST 1516.3-96<br>GOST 1983 – 2001 |
| 2. Lightning impulse test                               | GOST 1516.3-96<br>GOST 1983 – 2001 |
| 3. Power - frequency withstand test on primary windings | GOST 1516.3-96<br>GOST 1983 – 2001 |
| 4. Partial discharge measurement                        | GOST 1516.3-96<br>GOST 1983 – 2001 |

#### Results of tests performed on transformer VTD 12:

Serial No.: 030582

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Serial No.: 027913

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All tests and measurements have been performed in Technical laboratory ABB s.r.o , Brno.

**Ambient air conditions during tests:**

Temperature:	20,8° C
Rel. humidity:	36%
Pressure:	1003 hPa

#### Devices and equipment used:

1. High Voltage Test System WGBS, HIGHVOLT Pruftechnik Dresden GmbH
2. Digital partial discharge measuring system LDS-6, LEMKE Diagnostic GmbH
3. Impulse voltage test system IPF 20/400L, Nr 522423
4. Digital Impulse Voltage Measuring System TR – AS 25-8 , Dr.STRAUSS

#### List of symbols used:

$U_m$	Highest system voltage / highest voltage for equipment	[ kV ]
$U_p$	Rated primary voltage	[ kV ]
$U_{s1}$	Rated secondary voltage	[ V ]
$U_{s2}$	Rated secondary voltage	[ V ]
$f$	Rated frequency	[ Hz ]
$P_{s1}$	Rated output of the secondary winding	[ VA ]
$P_{s2}$	Rated output of the secondary winding	[ VA ]
$P_k$	Thermal limiting output	[ VA ]
$U_{zk}$	Test voltage	[ kV ]
$q$	Partial discharge level	[ pC ]



<b>Standard:</b>	GOST 1516.3-96, GOST 1983 – 2001		
<b>Type :</b>	VTD 12		
<b>Transformer ratio :</b>	6000 // 230	<b>Serial No. :</b>	030582
<b>Voltage class:</b>	(GOST 1516.3-96): 6	Highest voltage for equipment $U_m = 7,2 \text{ kV}$	

**1. Verification of terminal markings:** GOST 1516.3-96, GOST 1983 – 2001

- It was verified that the terminal markings are correct and in accordance with drawings.

**2. Lightning - impulse test:** GOST 1516.3-96, GOST 1983 – 2001

• **Voltage form: lightning impulse +/- 1,2 / 50 $\mu$ s:**

2.1 Test transformer was subjected to an impulse voltage test with 15 positive and 15 negative impulses. The test voltage was connected to the primary terminal A. The primary voltage terminal B and all end secondary voltage terminals were connected together and to earth.

Test voltage	impulses	flashovers	Result:
+ 60 kV	15	0	has passed
- 60 kV	15	0	has passed

2.2 Test transformer was subjected to an impulse voltage test with 15 positive and 15 negative impulses. The test voltage was connected to the primary terminal B. The primary voltage terminal A and all end secondary voltage terminals were connected together and to earth.

Test voltage	impulses	flashovers	Result:
+ 60 kV	15	0	has passed
- 60 kV	15	0	has passed

2.3 The test voltage applied between primary terminals connected together and secondary winding connected together and to earth:

Test voltage	impulses	flashovers	Result:
+ 60 kV	15	0	satisfactory
- 60 kV	15	0	satisfactory

• **Voltage form: chopped wave +/- 1,2 / (2-5) $\mu$ s:**

2.4 Test transformer was subjected to an impulse voltage test with 15 positive and 15 negative impulses. The test voltage was connected to the primary terminal A. The primary voltage terminal B and all end secondary voltage terminals were connected together and to earth.

Test voltage	impulses	flashovers	Result:
+ 70 kV	15	0	satisfactory
- 70 kV	15	0	satisfactory

2.5 Test transformer was subjected to an impulse voltage test with 15 positive and 15 negative impulses. The test voltage was connected to the primary terminal B. The primary voltage terminal A and all end secondary voltage terminals were connected together and to earth.

Test voltage	impulses	flashovers	Result:
+ 70 kV	15	0	has passed
- 70 kV	15	0	has passed

2.6 The test voltage applied between primary terminals connected together and secondary winding connected together and to earth:

Test voltage	impulses	flashovers	Result:
+ 70 kV	15	0	satisfactory
- 70 kV	15	0	satisfactory



<b>Standard:</b>	GOST 1516.3-96, GOST 1983 – 2001		
<b>Type :</b>	VTD 12		
<b>Transformer ratio :</b>	6000 // 230	<b>Serial No. :</b>	030582
<b>Voltage class:</b>	(GOST 1516.3-96): 6	Highest voltage for equipment $U_m = 7,2$ kV	

### 3. Power-frequency withstand test on primary windings: GOST 1516.3-96, GOST 1983 – 2001.

3.1 The test voltage applied between primary terminals (A+B) connected together and secondary winding connected together and to earth:

Test voltage	frequency	test duration	Result:
32 kV	50 Hz	60 sec.	has passed

3.2 The primary insulation of transformer was subjected to the specified induced voltage test with an elevated frequency. The test voltage was connected to the primary terminal A. The primary terminal B and all end secondary voltage terminals were connected together and to earth.

Test voltage	frequency	test duration	Result:
32 kV	201 Hz	60 sec.	has passed

3.3 The primary insulation of transformer was subjected to the specified induced voltage test with an elevated frequency. The test voltage was connected to the primary terminal B. The primary terminal A and all end secondary voltage terminals were connected together and to earth

Test voltage	frequency	test duration	Result:
32 kV	201 Hz	60 sec.	has passed

### 4. Partial discharge measurement: GOST 1516.3-96, GOST 1983 – 2001

- Test voltages were selected with respect to customer's requirement for  $U_m = 7,2$  kV.

Table 1. Partial discharge values for transformer VTD 12, No.: 030582

Test voltage:	Partial discharge level:	Note:
	A - connected to voltage B – connected to earth	(PD limit = 50/20 pC)
$U_t = 1,3 U_m - 10s$ (9,4 kV)	$q = 0,2$ pC	Informative value
$U_t = 1,1 U_m - 1$ min (8,6 kV)	$q = 0,2$ pC	Satisfactory
$U_t = U_m - 1min$ (7,2 kV)	$q = 0,2$ pC	Satisfactory
$U_t = 1,1 U_m / \sqrt{3} - 1$ min (4,6 kV)	$q = 0,2$ pC	Satisfactory
	B - connected to voltage A – connected to earth	(PD limit = 50/20 pC)
$U_t = 1,3 U_m - 10s$ (9,4 kV)	$q = 0,2$ pC	Informative value
$U_t = 1,1 U_m - 1$ min (8,6 kV)	$q = 0,2$ pC	Satisfactory
$U_t = U_m - 1min$ (7,2 kV)	$q = 0,2$ pC	Satisfactory
$U_t = 1,1 U_m / \sqrt{3} - 1$ min (4,6 kV)	$q = 0,2$ pC	Satisfactory



<b>Standard:</b>	GOST 1516.3-96, GOST 1983 – 2001		
<b>Type :</b>	VTD 12		
<b>Transformer ratio :</b>	10500 // 100	<b>Serial No. :</b>	027913
<b>Voltage class:</b>	(GOST 1516.3-96): 10	Highest voltage for equipment Um = 12 kV	

**1. Verification of terminal markings:** GOST 1516.3-96, GOST 1983 – 2001

- It was verified that the terminal markings are correct and in accordance with drawings.

**2. Lightning - impulse test:** GOST 1516.3-96, GOST 1983 – 2001

• **Voltage form: lightning impulse +/- 1,2 / 50µs:**

2.1 Test transformer was subjected to an impulse voltage test with 15 positive and 15 negative impulses. The test voltage was connected to the primary terminal A. The primary voltage terminal B and all end secondary voltage terminals were connected together and to earth.

Test voltage	impulses	flashovers	Result:
+ 75 kV	15	0	has passed
– 75 kV	15	0	has passed

2.2 Test transformer was subjected to an impulse voltage test with 15 positive and 15 negative impulses. The test voltage was connected to the primary terminal B. The primary voltage terminal A and all end secondary voltage terminals were connected together and to earth.

Test voltage	impulses	flashovers	Result:
+ 75 kV	15	0	has passed
– 75 kV	15	0	has passed

2.3 The test voltage applied between primary terminals connected together and secondary winding connected together and to earth:

Test voltage	impulses	flashovers	Result:
+ 75 kV	15	0	satisfactory
– 75 kV	15	0	satisfactory

• **Voltage form: chopped wave +/- 1,2 / (2-5)µs:**

2.4 Test transformer was subjected to an impulse voltage test with 15 positive and 15 negative impulses. The test voltage was connected to the primary terminal A. The primary voltage terminal B and all end secondary voltage terminals were connected together and to earth.

Test voltage	impulses	flashovers	Result:
+ 90 kV	15	0	satisfactory
– 90 kV	15	0	satisfactory

2.5 Test transformer was subjected to an impulse voltage test with 15 positive and 15 negative impulses. The test voltage was connected to the primary terminal B. The primary voltage terminal A and all end secondary voltage terminals were connected together and to earth.

Test voltage	impulses	flashovers	Result:
+ 90 kV	15	0	has passed
– 90 kV	15	0	has passed

2.6 The test voltage applied between primary terminals connected together and secondary winding connected together and to earth:

Test voltage	impulses	flashovers	Result:
+ 90 kV	15	0	satisfactory
– 90 kV	15	0	satisfactory



<b>Standard:</b>	GOST 1516.3-96, GOST 1983 – 2001		
<b>Type :</b>	VTD 12		
<b>Transformer ratio :</b>	10500 // 100	<b>Serial No. :</b>	027913
<b>Voltage class:</b>	(GOST 1516.3-96): 10	Highest voltage for equipment $U_m = 12$ kV	

### 3. Power-frequency withstand test on primary windings: GOST 1516.3-96, GOST 1983 – 2001.

3.1 The test voltage applied between primary terminals (A+B) connected together and secondary winding connected together and to earth:

Test voltage	frequency	test duration	Result:
42 kV	50 Hz	60 sec.	has passed

3.2 The primary insulation of transformer was subjected to the specified induced voltage test with an elevated frequency. The test voltage was connected to the primary terminal A. The primary terminal B and all end secondary voltage terminals were connected together and to earth.

Test voltage	frequency	test duration	Result:
42 kV	147 Hz	60 sec.	has passed

3.3 The primary insulation of transformer was subjected to the specified induced voltage test with an elevated frequency. The test voltage was connected to the primary terminal B. The primary terminal A and all end secondary voltage terminals were connected together and to earth

Test voltage	frequency	test duration	Result:
42 kV	147 Hz	60 sec.	has passed

### 4. Partial discharge measurement: GOST 1516.3-96, GOST 1983 – 2001

- Test voltages were selected with respect to customer's requirement for  $U_m = 12$  kV.

Table 1. Partial discharge values for transformer VTD 12, No.: 027913

Test voltage:	Partial discharge level:	Note:
	A - connected to voltage B - connected to earth	(PD limit = 50/20 pC)
$U_t = 1,3 U_m - 10s$ (15,6 kV)	$q = 160$ pC	Informative value
$U_t = 1,1 U_m - 1$ min (13,2 kV)	$q = 0,4$ pC	Satisfactory
$U_t = U_m - 1min$ (12 kV)	$q = 0,2$ pC	Satisfactory
$U_t = 1,1 U_m / \sqrt{3} - 1$ min (7,6 kV)	$q = 0,2$ pC	Satisfactory
	B - connected to voltage A - connected to earth	(PD limit = 50/20 pC)
$U_t = 1,3 U_m - 10s$ (15,6 kV)	$q = 350$ pC	Informative value
$U_t = 1,1 U_m - 1$ min (13,2 kV)	$q = 46$ pC	Satisfactory
$U_t = U_m - 1min$ (12 kV)	$q = 45$ pC	Satisfactory
$U_t = 1,1 U_m / \sqrt{3} - 1$ min (7,6 kV)	$q = 1,8$ pC	Satisfactory