



VEBKO ONLINE HELP

Capacitive Voltage Transformers

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Voltage transformers are composed of a core, two windings, and insulation. VTs convert the high voltage of the primary side to low voltage on their secondary winding with the turn ratio written on their plate.

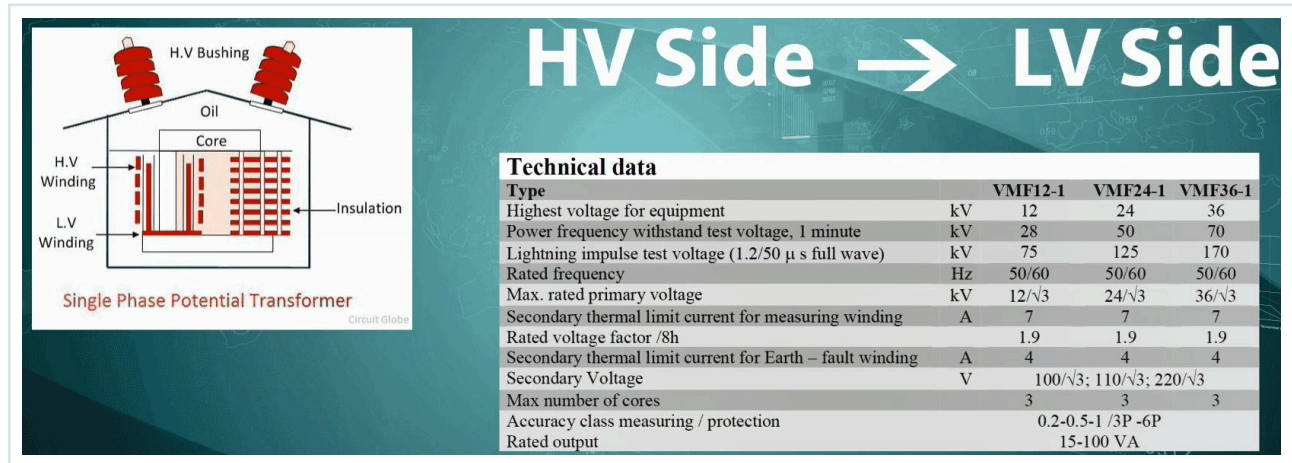


Figure 1

Because of the internal casualties such as copper and iron casualties, the vector of the secondary voltage is different from the primary voltage. Moreover, the connected burden is capable of affecting the turn ratio error and phase displacement. If the actual amplitude of the secondary voltage is lower than nominal secondary voltage, the amplitude error is negative. Also, if the secondary vector is lagging in relation to the primary vector, the phase error is negative.

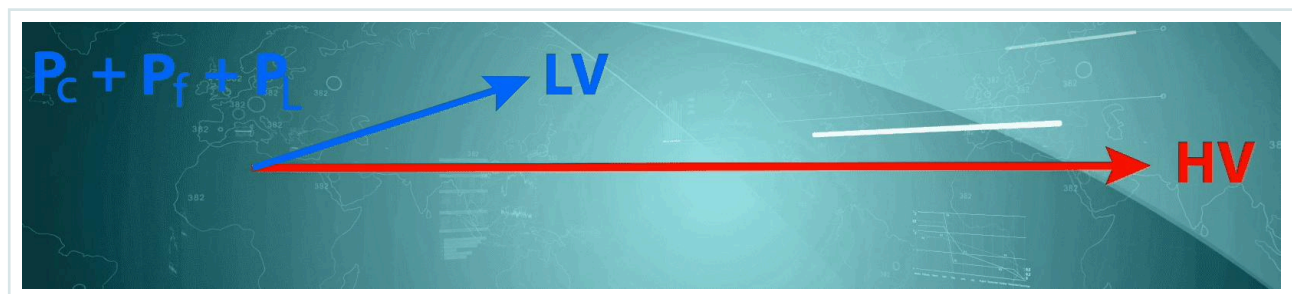


Figure 2

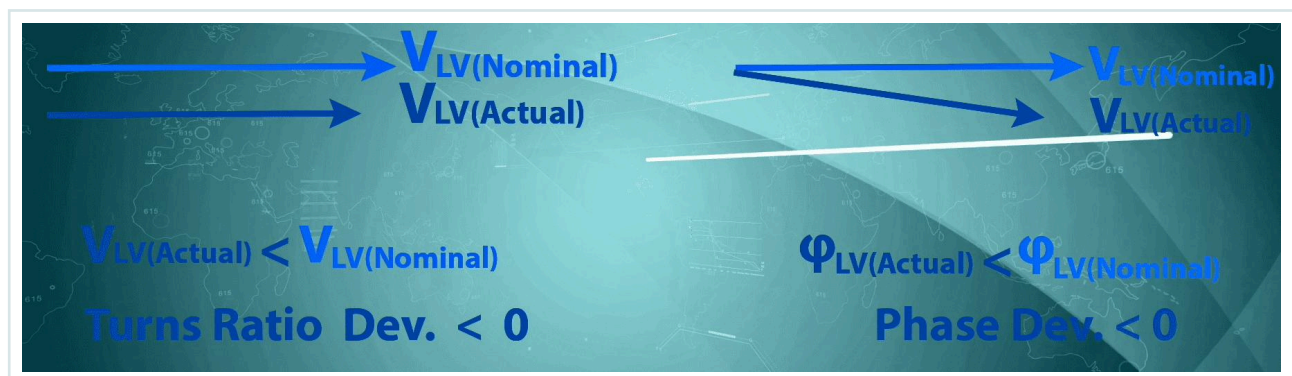


Figure 3

To compensate for the turn ratio error, sometimes manufacturers adjust the number of primary or secondary turns. Nowadays, most of the VTs that are used in the industry are either inductive VTs or capacitive VTs which are called "CVT".

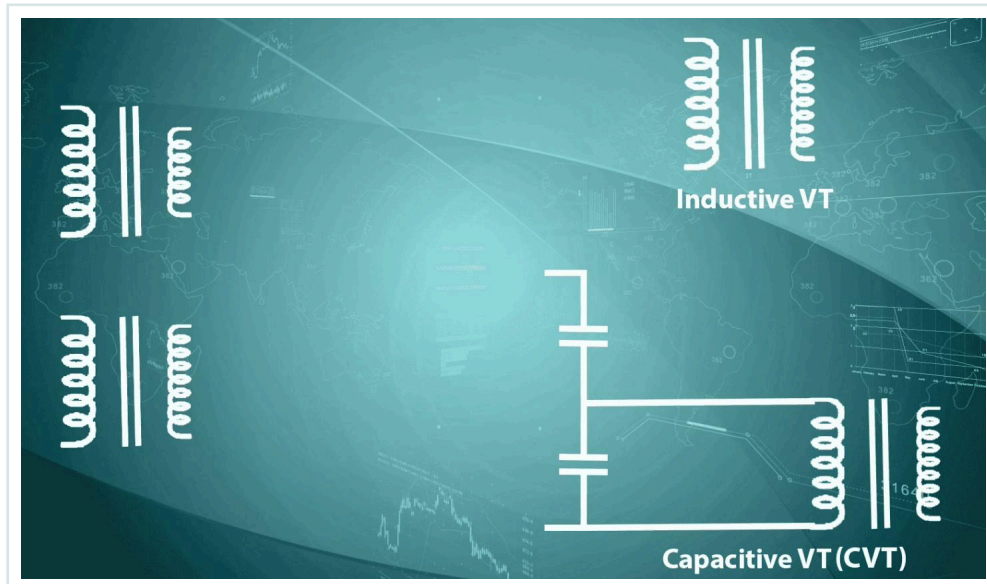


Figure 4

CVTs are composed of an inductive VT, a high-voltage capacitive divider and a compensator reactor. In the IEC standard, the title CVT is used for this equipment but in the ANSI standard, this equipment is called CCVT. The compensator reactor is designed in a way that it can compensate for the phase displacement caused by the capacitive divider.

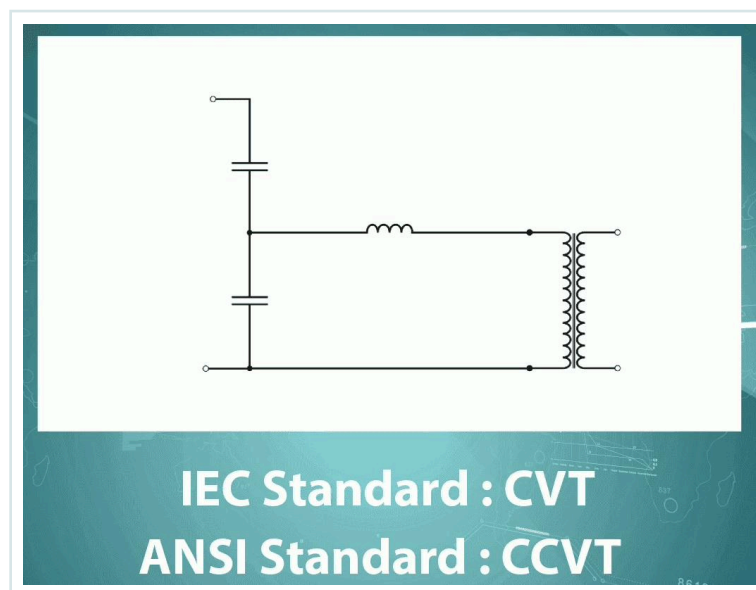


Figure 5

All CVTs can be used for measurement purposes but only certain types of this equipment are suitable

for protection purposes. Dual-purpose CVTs (measurement and protection) must be in accordance with all of the considered descriptions and the current standards.

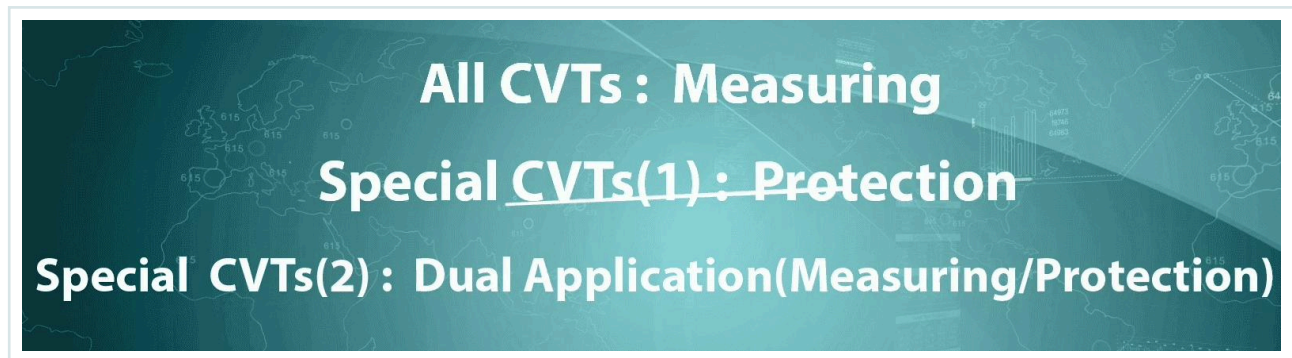


Figure 6

According to the maximum allowed error percentage, the accuracy class of the protection CVTs is considered to be from 5 percent of the nominal voltage to a coefficient of the nominal voltage (Rated Voltage Factor) and after its value, the letter P is used. 3P and 6P are the standard accuracy classes for protection CVTs. For example, 3P accuracy class means that the maximum allowed error is 3 percent. Moreover, in IEC standard, three classes of T1, T2 and T3 are considered for the function of CVT in transient state. For example, 3PT2 class indicates that the function of the 3P class is for protection purposes and T2 class is for transient states.

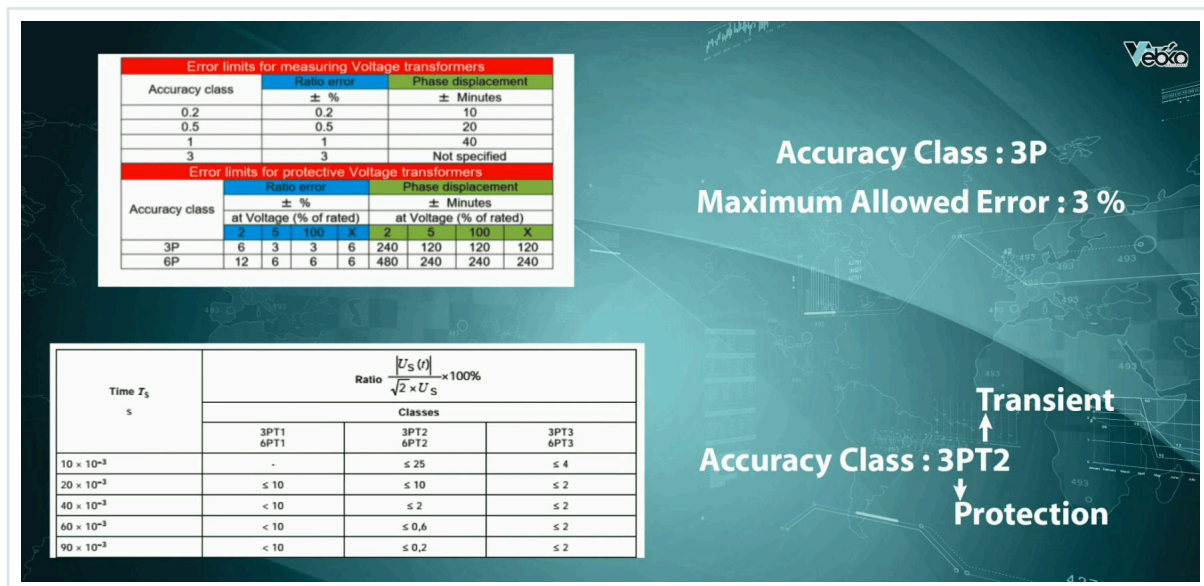


Figure 7

Classes related to the transient response are defined in the following table:

Time T_S s	Ratio $\frac{ U_S(t) }{\sqrt{2} \times U_S} \times 100\%$		
	3PT1 6PT1	3PT2 6PT2	3PT3 6PT3
10×10^{-3}	-	≤ 25	≤ 4
20×10^{-3}	≤ 10	≤ 10	≤ 2
40×10^{-3}	< 10	≤ 2	≤ 2
60×10^{-3}	< 10	≤ 0,6	≤ 2
90×10^{-3}	< 10	≤ 0,2	≤ 2

Figure 8

In the above relation, $U_s(t)$ is the response for the transient secondary voltage. For example, for the 3PT2 class, the relation of the transient voltage to the nominal voltage peak from 10 ms to 90 ms after the beginning of the transient state, It should decrease and be in the range of less than 25 times to 0.2.

In this regard, it is necessary to pay attention to several points:

CVTs need a damping piece of equipment for the 6PT3 and 3PT3 transient response classes.

By agreement between the manufacturer company and the customer, it is possible to consider different values for the turn ratio and T_s time.

Selecting the transient response class depends on the characteristics of the protection relays.

Notes :

- 1 - 3PT3 & 6PT3 : Damping Equipment
- 2 - Customizing Ratio & Transient time
- 3- Transient Response Class Depends on Protection Relay

Figure 9

About Measuring CVTs, the accuracy class is defined based on the highest allowed error percentage in the nominal voltage with the nominal burden. The standard accuracy classes for single-phase Measuring CVTs are considered to be 0.2, 0.5, 1.0 and 3.0.

Error limits for measuring Voltage transformers				
Accuracy class	Ratio error		Phase displacement	
	± %		± Minutes	
0.2	0.2		10	
0.5	0.5		20	
1	1		40	
3	3		Not specified	

Error limits for protective voltage transformers								
Accuracy class	Ratio error				Phase displacement			
	± %				± Minutes			
	at Voltage (% of rated)				at Voltage (% of rated)			
	2	5	100	X	2	5	100	X
3P	6	3	3	6	240	120	120	120
6P	12	6	6	6	480	240	240	240

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Figure 10

1 Test Object tab

To perform a test, every module needs a set of information about the equipment which is entered in "Test Object". In this tab, the general characteristics of the "CVT" and its information for performing the test and adding to the report are specified. In "Data" section, information such as serial number, model, the manufacturer company and the installation location of the "CVT" are entered to be added to the report.

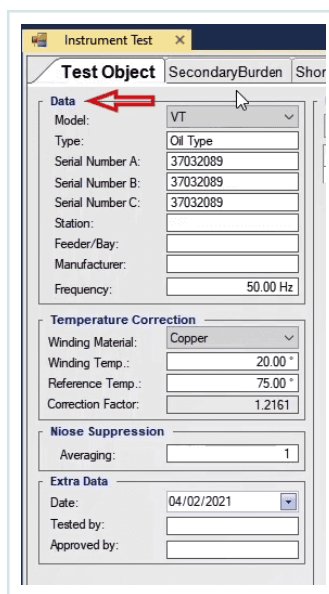


Figure 11

In "Winding Material" field in "Temperature Correction" section, the conductor type of the windings is selected from among "Copper" and "Aluminum". In "Winding Temp." field the current temperature of the windings and in "Reference Temp." field, the reference temperature for measuring the resistance of the windings are entered so that they can be used to correct the values measured in different temperatures. Usually, the reference temperature which is 75 degrees is written in front of the secondary winding resistance on the plate of the "CVT". In "Correction Factor" field which is uneditable, the temperature correction factor is calculated by the software in accordance with the current ambient temperature as well as the reference temperature and the winding material. It is possible to view the relation used for calculating this factor, by holding the cursor on its field.

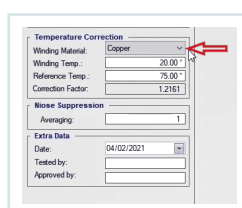


Figure 12

The „RMS“ value of every parameter is calculated based on the average of several time periods. As the number of these time periods increases, it takes longer to make the calculations but also the accuracy increases and there will be fewer fluctuations. The number of these time periods is entered in „Averaging“ field in „Noise Suppression“ section. This field is the same as „No. of period“ field in „Setting“ in „Signal View“ window.

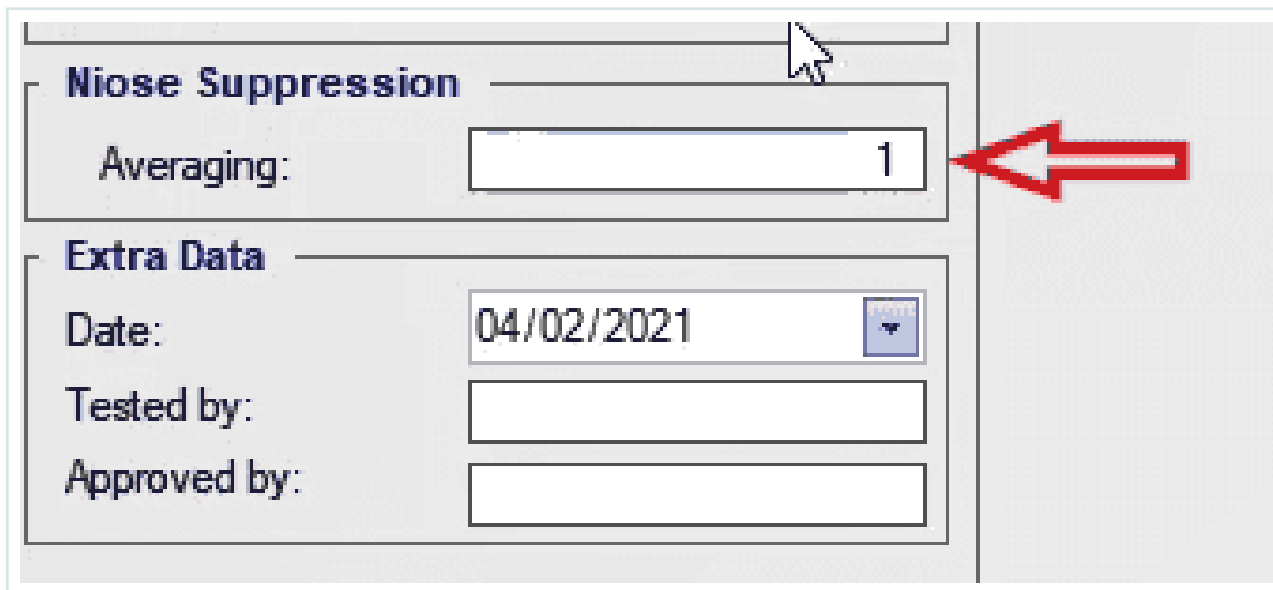


Figure 13

In „Date“ field in „Extra Data“ section, the date of performing the test is entered in AD and the information about the performer of the test is entered in „Tested By“ field. Also, the information about the supervisor is entered in „Approved By“ field.

In „Data Table“, the characteristics of every core and tap are entered in every row in accordance with the characteristics plate. The core number and the tap number are entered in „Core Number“ and „Tap Number“ fields, respectively. The primary parameters are entered in „Vprimary“ and „Primary Factor“ fields while the secondary characteristics are entered in „Vsecondary“ and „Secondary Factor“ fields. The burden is specified in „VA“ field and in „CLP“ and „CLM“ fields, the Protection Core and Measuring of the transformer are entered, respectively. Likewise, the information related to the two other taps of the CVT that are being used is specified. Also, if the characteristics of the „VT resistance“ are available, it is possible to check „Show Resistance Column“ option to add the related column to the table. By checking this option, some changes are made in the „DC Resistance“ test table which will be thoroughly explained in its related video.

Data Table										
Add Row		Show Resistance Column								
	Core No.	Tap No.	V _{prim}	Primary Factor	V _{sec}	Secondary Factor	VA	CLP	CLM	R _{nom}
1	1	1	25.00 kV [50%]	1	110.0 V [50%]	1	25.00 VA 1P	0.2	100.0 mΩ	
2	2	1	25.00 kV [50%]	1	110.0 V [50%]	1	25.00 VA 1P	0.2	100.0 mΩ	
3	3	1	25.00 kV [50%]	1	110.0 V [50%]	1	0.000 VA 1P	0.2	100.0 mΩ	

Figure 14

Also, by pressing the „Add to Report“ option in the box at the bottom, this information is added to the output report and a message stating „The Report was added to the list“ is displayed. It is possible to view the report by selecting „Report“ window from the bar at the right. By clicking on „Delete Report“ option in „Delete From Repor“ window, the added report is removed. If „Set as default“ option is checked, the entered information is saved as default and every time, by opening the „Capacitor Voltage Transformer(CVT)“ room this information is displayed.

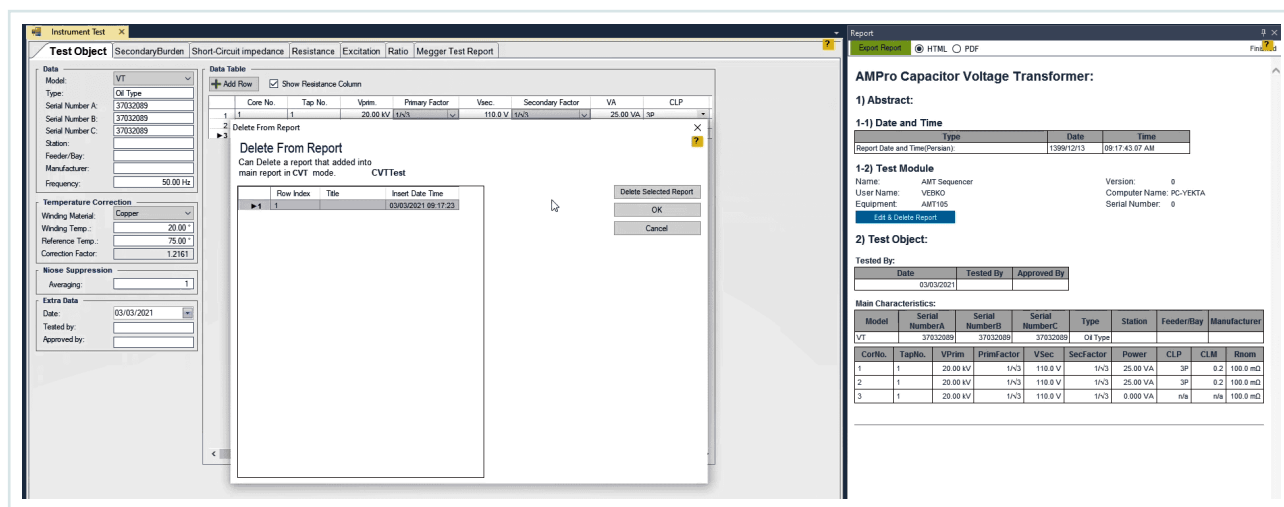


Figure 15

[jg1]CVT_Voltage_transformers