# TESTING THE KNEE-POINT OF CURRENT TRANSFORMERS WITH PTE-100-C.

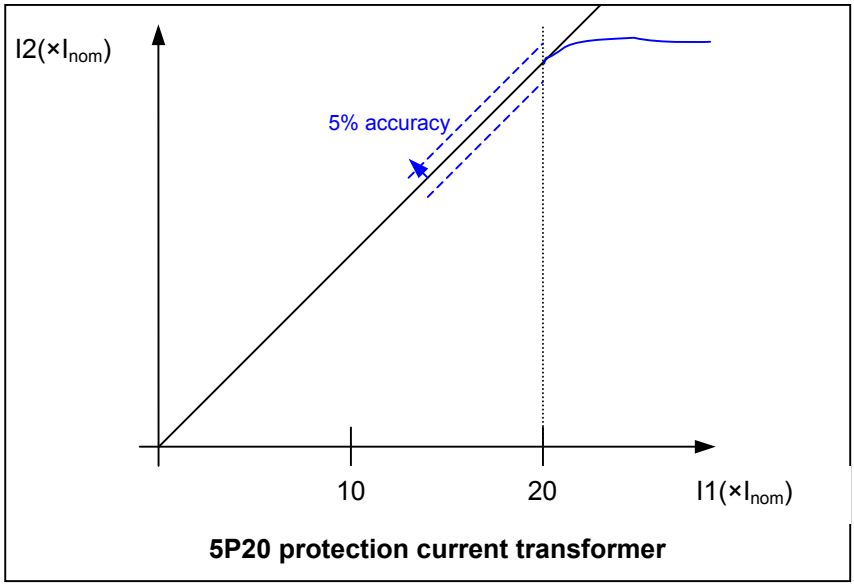
## 1. Introduction

The knee-point of any transformer is the point at which the core starts to saturate presenting thus a low impedance path for the current to flow. The ratio then is not accurate enough and due to this reason it may cause misoperation of the protective relays. In order to overcome this problem it must be ensured that the current transformers at any point of the grid should have the knee point above the values of typical short circuit currents.

## 2. Definition of current transformers.

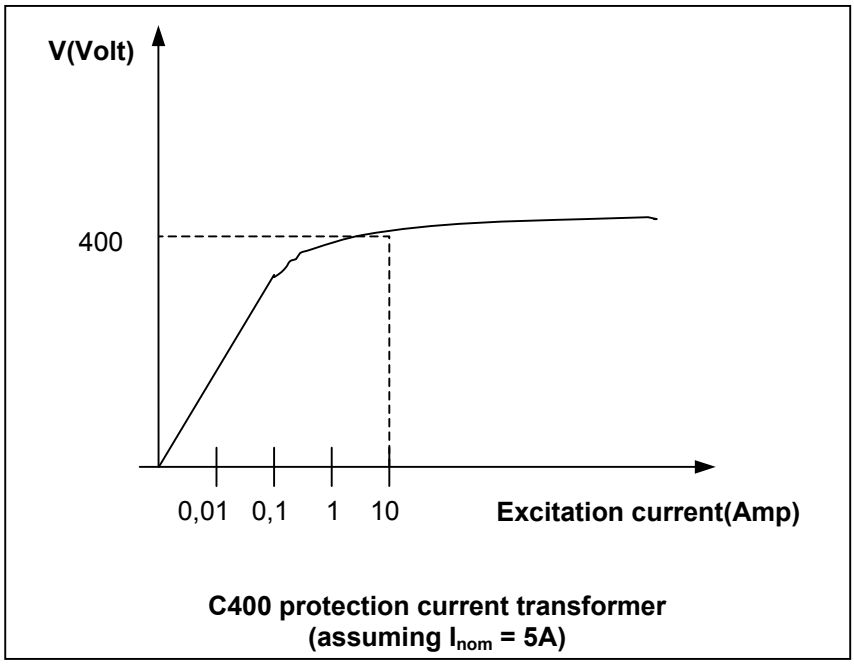
There are two criteria used widespread to define the protection current transformers from the saturation point of view:

2.1.- *Percent ratio correction factor:* This means the current percentage which does not flow to the secondary side, i.e , which is kept inside the transformer due to saturation. For instance a 5P20 current transformer means that as long as the primary current is below 20 times the nominal , the percent ratio correction factor will be better than 5%.For higher primary currents, the percentage ratio correction factor increases thus keeping the secondary current constant.




**5P20 protection current transformer**

2.2.- *Secondary voltage rating:* This means the secondary voltage the CT will support across a standard burden with 20 times rated current without exceeding 10 percent ratio correction.



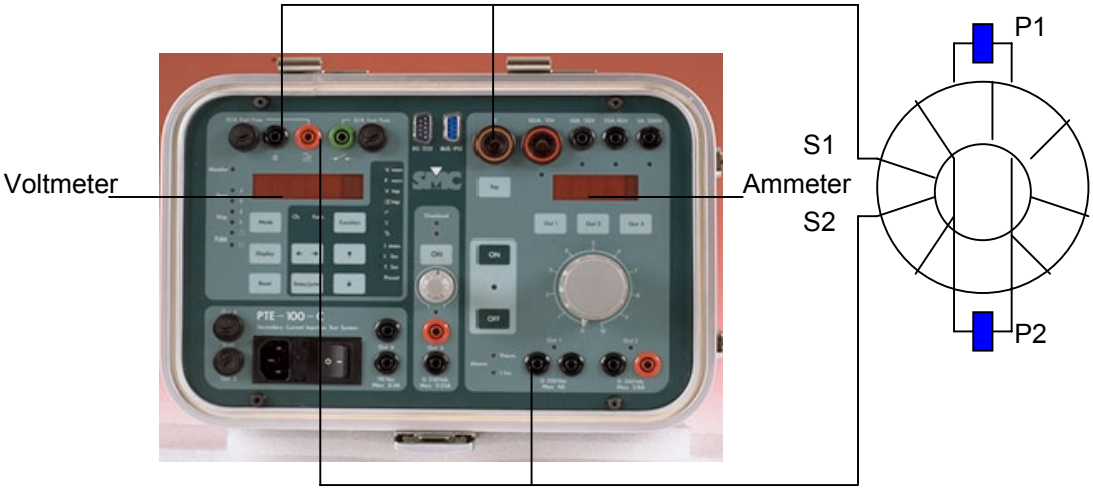

**C400 protection current transformer (assuming $I_{nom}$ = 5A)**

This concept is the one used for testing the knee-point in current transformers with the PTE-100-C.

At the knee-point the voltage across the secondary tends to remain constant whereas the current continues to rise.

## 3. Knee-point test with PTE-100-C.

In order to properly test the knee-point the connections must be as follows:




- OUT1, A.C.Voltage output to 250 V is connected to the secondary terminals of the current transformer between the common of the main current output and the active tap of OUT1 so as to allow the measurement of the excitation current in display1
- Display 1 is used as ammeter to measure the excitation current.
- Voltage monitor is connected in parallel with the secondary voltage and the $V_{mon}$ function is selected in the PTE-100-C.
- Display 2 is used as voltmeter to measure the secondary voltage.

The voltage across OUT1 is increased starting from zero. The excitation current increases too until the knee-point where voltage remains constant and the excitation current keeps increasing.

It is possible to measure the load angle presented by the current transformer, i.e, the angle between the secondary voltage and the excitation current by means of the PTE-100-C built-in function $\varphi_{measurement}$.