Current Transformer Requirements

The requirements for phase current transformers are usually determined by the overcurrent time protection, particularly by the high-current element settings. Besides, there is a minimum requirement based on experience.

The recommendations are given according to the standard IEC 60044-1.

The standards IEC 60044-6, BS 3938 and ANSI/IEEE C 57.13 are referred to for converting the requirement into the knee-point voltage and other transformer classes.

Accuracy limiting factors

Effective and Rated Accuracy Limiting Factor

<table>
<tr><td rowspan="5">Required minimum effective accuracy limiting factor</td><td colspan="2">$K_{ALF'} = \frac{50 - 2_{PU}}{I_{pNom}}$
but at least 20</td></tr>
<tr><td colspan="2">with</td></tr>
<tr><td>$K_{ALF'}$</td><td>Minimum operating overcurrent factor</td></tr>
<tr><td>$50\text{-}2_{PU}$</td><td>Primary pickup value of the high-current element</td></tr>
<tr><td>I_{pNom}</td><td>Primary nominal transformer current</td></tr>
<tr><td rowspan="5">Resulting rated accuracy limiting factor</td><td colspan="2">$K_{ALF} = \frac{R_{BC} + R_{Ct}}{R_{BN} + R_{Ct}} \cdot K_{ALF'}$</td></tr>
<tr><td colspan="2">with</td></tr>
<tr><td>K_{ALF}</td><td>Rated accuracy limiting factor</td></tr>
<tr><td>R_{BC}</td><td>Connected burden resistance (device and cables)</td></tr>
<tr><td></td><td></td></tr>
</table>

	R_{BN}	Nominal burden resistance
	R_{Ct}	Transformer internal burden resistance

Calculation example according to IEC 60044–1

I_{sNom} = 1 A $K_{ALF'}$ = 20 R_{BC} = 0.6 Ω (device and cables) R_{Ct} = 3 Ω R_{BN} = 5 Ω (5 VA)	$$K_{ALF} = \frac{0.6+3}{5+3} \cdot 20 = 9$$ K_{ALF} set to 10, so that: 5P10, 5 VA
with I_{sNom} = secondary transformer nominal current	

Class conversion

Conversion into other classes

British Standard BS 3938	$$V_k = \frac{(R_{Ct}+R_{BN}) \cdot I_{sNom}}{1.3} \cdot K_{ALF}$$
ANSI/IEEE C 57.13, class C	$$V_{s.t.max} = 20 \cdot I_{sNom} \cdot R_{BN} \cdot \frac{K_{ALF}}{20}$$ I_{sNom} = 5 A (typical value)
IEC 60044-6 (transient response), class TPS Classes TPX, TPY, TPZ	$$V_{al} = K \cdot K_{SSC} \cdot (R_{Ct}+R_{BN}) \cdot I_{sNom}$$ K≈ 1 $K_{SSC} \approx K_{ALF}$ Calculated as in See ChapterAccuracy limiting factors where: $K_{SSC} \approx K_{ALF}$ T_P depending on power system and specified closing sequence

	with	
	V_k	Knee-point voltage
	R_{Ct}	Internal burden resistance
	R_{BN}	Nominal burden resistance
	I_{sNom}	secondary nominal transformer current
	K_{ALF}	Rated accuracy limiting factor
	$V_{s.t.max}$	sec. terminal volt. at 20 I_{pNom}
	V_{al}	sec. magnetization limit voltage
	K	Dimensioning factor
	K_{SSC}	Factor symmetr. Rated fault current
	T_P	Primary time constant

Cable core balance current transformer

General

The requirements to the cable core balance current transformer are determined by the function „sensitive ground fault detection“.

The recommendations are given according to the standard IEC 60044-1.

Requirements

Transformation ratio, typical It may be necessary to select a different transformation ratio to suit the specific power system and thus the amount of the maximum ground fault current.	60 / 1
Accuracy limiting factor	FS = 10
Power	2.5 VA

Class accuracy

Minimum required class accuracy depending on neutral grounding and function operating principle

Starpoint	isolated	compensated	high-resistance grounded
Function directional	Class 1	Class 1	Class 1
Function non-directional	Class 3	Class 1	Class 3

For extremely small ground fault currents it may become necessary to correct the angle at the device (see function description of „sensitive ground fault detection“).