

TECHNICAL REPORT



Instrument transformers –
Part 100: Guidance for application of current transformers in power system
protection

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CONTENTS

FOREWORD.....	7
INTRODUCTION.....	9
1 Scope.....	10
2 Normative references	10
3 Terms and definitions and abbreviations.....	10
3.1 Terms and definitions.....	10
3.2 Index of abbreviations.....	12
4 Responsibilities in the current transformer design process.....	14
4.1 History.....	14
4.2 Subdivision of the current transformer design process	14
5 Basic theoretical equations for transient designing	15
5.1 Electrical circuit	15
5.1.1 General	15
5.1.2 Current transformer	18
5.2 Transient behaviour	20
5.2.1 General	20
5.2.2 Fault inception angle	22
5.2.3 Differential equation	23
6 Duty cycles.....	25
6.1 Duty cycle C – O.....	25
6.1.1 General	25
6.1.2 Fault inception angle	27
6.1.3 Transient factor K_{tf} and transient dimensioning factor K_{td}	28
6.1.4 Reduction of asymmetry by definition of the minimum current inception angle	51
6.2 Duty cycle C – O – C – O	53
6.2.1 General	53
6.2.2 Case A:No saturation occurs until t'	54
6.2.3 Case B:Saturation occurs between t'_{al} and t'	56
6.3 Summary	58
7 Determination of the transient dimensioning factor K_{td} by numerical calculation.....	61
7.1 General.....	61
7.2 Basic circuit	61
7.3 Algorithm	63
7.4 Calculation method	63
7.5 Reference examples	64
8 Core saturation and remanence.....	70
8.1 Saturation definition for common practice	70
8.1.1 General	70
8.1.2 Definition of the saturation flux in the preceding standard IEC 60044-1	70
8.1.3 Definition of the saturation flux in IEC 61869-2	72
8.1.4 Approach “5 % – Factor 5”	73
8.2 Gapped cores versus non-gapped cores	74
8.3 Possible causes of remanence.....	76
9 Practical recommendations.....	80
9.1 Accuracy hazard in case various PR class definitions for the same core	80

9.2	Limitation of the phase displacement $\Delta\varphi$ and of the secondary loop time constant T_S by the transient dimensioning factor K_{td} for TPY cores	80
10	Relations between the various types of classes	81
10.1	Overview.....	81
10.2	Calculation of e.m.f. at limiting conditions	81
10.3	Calculation of the exciting (or magnetizing) current at limiting conditions	82
10.4	Examples	82
10.5	Minimum requirements for class specification	83
10.6	Replacing a non-gapped core by a gapped core.....	83
11	Protection functions and correct CT specification	84
11.1	General.....	84
11.2	General application recommendations	84
11.2.1	Protection functions and appropriate classes	84
11.2.2	Correct CT designing in the past and today	86
11.3	Overcurrent protection: ANSI code: (50/51/50N/51N/67/67N); IEC symbol: I>	88
11.3.1	Exposition.....	88
11.3.2	Recommendation.....	90
11.3.3	Example	90
11.4	Distance protection: ANSI codes: 21/21N, IEC code: Z<	90
11.4.1	Exposition.....	90
11.4.2	Recommendations	92
11.4.3	Examples.....	92
11.5	Differential protection.....	99
11.5.1	Exposition.....	99
11.5.2	General recommendations	100
11.5.3	Transformer differential protection (87T).....	100
11.5.4	Busbar protection: Ansi codes (87B).....	105
11.5.5	Line differential protection: ANSI codes (87L) (Low impedance)	108
11.5.6	High impedance differential protection	111
	Annex A (informative) Duty cycle C – O software code.....	130
	Annex B (informative) Software code for numerical calculation of K_{td}	132
	Bibliography.....	137
	Figure 1 – Definition of the fault inception angle γ	12
	Figure 2 – Components of protection circuit	16
	Figure 3 – Entire electrical circuit.....	17
	Figure 4 – Primary short circuit current	18
	Figure 5 – Non-linear flux of L_{ct}	19
	Figure 6 – Linearized magnetizing inductance of a current transformer	20
	Figure 7 – Simulated short circuit behaviour with non-linear model	21
	Figure 8 – Three-phase short circuit behaviour	23
	Figure 9 – Composition of flux	24
	Figure 10 – Short circuit current for two different fault inception angles	26
	Figure 11 – ψ_{max} as the curve of the highest flux values.....	26
	Figure 12 – Primary current curves for the 4 cases for 50 Hz and $\varphi = 70^\circ$	27
	Figure 13 – Four significant cases of short circuit currents with impact on magnetic saturation of current transformers	28

Figure 14 – Relevant time ranges for calculation of transient factor 31

Figure 15 – Occurrence of the first flux peak depending on T_p , at 50 Hz 32

Figure 16 – Worst-case angle $\theta_{tf,\psi_{max}}$ as function of T_p and t'_{al} 33

Figure 17 – Worst-case fault inception angle $\gamma_{tf,\psi_{max}}$ as function of T_p and t'_{al} 34

Figure 18 – $K_{tf,\psi_{max}}$ calculated with worst-case fault inception angle $\theta_{\psi_{max}}$ 34

Figure 19 – Polar diagram with $K_{tf,\psi_{max}}$ and $\gamma_{tf,\psi_{max}}$ 35

Figure 20 – Determination of K_{tf} in time range 1 40

Figure 21 – Primary current curves for 50Hz, $T_p = 1$ ms, $\gamma_{\psi_{max}} = 166^\circ$ for $t'_{al} = 2$ ms 41

Figure 22 – worst-case fault inception angles for 50Hz, $T_p = 50$ ms and $T_s = 61$ ms 42

Figure 23 – transient factor for different time ranges 43

Figure 24 – K_{tf} in all time ranges for $T_s = 61$ ms at 50 Hz with t'_{al} as parameter 44

Figure 25 – Zoom of Figure 24 45

Figure 26 – Primary current for a short primary time constant 45

Figure 27 – K_{tf} values for a short primary time constant 46

Figure 28 – Short circuit currents for various fault inception angles 47

Figure 29 – Transient factors for various fault inception angles (example) 48

Figure 30 – Worst-case fault inception angles for each time step (example for 50 Hz) 48

Figure 31 – Primary current for two different fault inception angles (example for 16,67 Hz) 49

Figure 32 – Transient factors for various fault inception angles (example for 16,67 Hz) 50

Figure 33 – Worst-case fault inception angles for every time step (example for 16,67 Hz) 50

Figure 34 – Fault occurrence according to Warrington 51

Figure 35 – estimated distribution of faults over several years 52

Figure 36 – Transient factor K_{tf} calculated with various fault inception angles γ 53

Figure 37 – Flux course in a C-O-C-O cycle of a non-gapped core 54

Figure 38 – Typical flux curve in a C-O-C-O cycle of a gapped core, with higher flux in the second energization 55

Figure 39 – Flux curve in a C-O-C-O cycle of a gapped core, with higher flux in the first energization 56

Figure 40 – Flux curve in a C-O-C-O cycle with saturation allowed 57

Figure 41 – Core saturation used to reduce the peak flux value 58

Figure 42 – Curves overview for transient designing 59

Figure 43 – Basic circuit diagram for numerical calculation of K_{td} 62

Figure 44 – K_{td} calculation for C-O cycle 65

Figure 45 – K_{td} calculation for C-O-C-O cycle without core saturation in the first cycle 66

Figure 46 – K_{td} calculation for C-O-C-O cycle considering core saturation in the first cycle 67

Figure 47 – K_{td} calculation for C-O-C-O cycle with reduced asymmetry 68

Figure 48 – K_{td} calculation for C-O-C-O cycle with short t'_{al} and t''_{al} 69

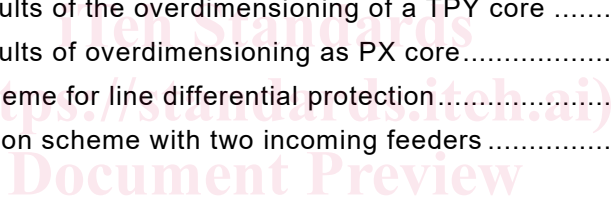
Figure 49 – K_{td} calculation for C-O-C-O cycle for a non-gapped core 70

Figure 50 – Comparison of the saturation definitions according to IEC 60044-1 and according to IEC 61869-2 71

Figure 51 – Remanence factor K_r according to the previous definition IEC 60044-1 72

Figure 52 – Determination of saturation and remanence flux using the DC method for a gapped core.....	73
Figure 53 – Determination of saturation and remanence flux using DC method for a non-gapped core.....	73
Figure 54 – CT secondary currents as fault records of arc furnace transformer.....	77
Figure 55 – 4-wire connection.....	78
Figure 56 – CT secondary currents as fault records in the second fault of auto reclosure.....	79
Figure 57 – Application of instantaneous/time-delay overcurrent relay (ANSI codes 50/51) with definite time characteristic.....	89
Figure 58 – Time-delay overcurrent relay, time characteristics.....	89
Figure 59 – CT specification example, time overcurrent.....	90
Figure 60 – Distance protection, principle (time distance diagram).....	91
Figure 61 – Distance protection, principle (R/X diagram).....	92
Figure 62 – CT Designing example, distance protection.....	93
Figure 63 – Primary current with C-O-C-O duty cycle.....	97
Figure 64 – Transient factor K_{tf} with its envelope curve K_{tfp}	97
Figure 65 – Transient factor K_{tf} for CT class TPY with saturation in the first fault.....	98
Figure 66 – Transient factor K_{tf} for CT class TPZ with saturation in the first fault.....	98
Figure 67 – Transient factor K_{tf} for CT class TPX.....	99
Figure 68 – Differential protection, principle.....	100
Figure 69 – Transformer differential protection, faults.....	101
Figure 70 – Transformer differential protection.....	102
Figure 71 – Busbar protection, external fault.....	105
Figure 72 – Simulated currents of a current transformer for bus bar differential protection.....	108
Figure 73 – CT designing for a simple line with two ends.....	109
Figure 74 – Differential protection realized with a simple electromechanical relay.....	112
Figure 75 – High impedance protection principle.....	113
Figure 76 – Phasor diagram for external faults.....	114
Figure 77 – Phasor diagram for internal faults.....	115
Figure 78 – Magnetizing curve of CT.....	116
Figure 79 – Single-line diagram of busbar and high impedance differential protection.....	120
Figure 80 – Currents at the fault location (primary values).....	122
Figure 81 – Primary currents through CTs, scaled to CT secondary side.....	122
Figure 82 – CT secondary currents.....	123
Figure 83 – Differential voltage.....	123
Figure 84 – Differential current and r.m.s. filter signal.....	124
Figure 85 – Currents at the fault location (primary values).....	124
Figure 86 – Primary currents through CTs, scaled to CT secondary side.....	125
Figure 87 – CT secondary currents.....	125
Figure 88 – Differential voltage.....	126
Figure 89 – Differential current and r.m.s. filtered signal.....	126
Figure 90 – Currents at the fault location (primary values).....	127
Figure 91 – Primary currents through CTs, scaled to CT secondary side.....	127

Figure 92 – CT secondary currents	128
Figure 93 – Differential voltage	128
Figure 94 – Differential current and r.m.s. filtered signal	129
Figure 95 – Differential voltage without varistor limitation.....	129
Table 1 – Four significant cases of short circuit current inception angles	27
Table 2 – Equation overview for transient designing	60
Table 3 – Comparison of saturation point definitions	74
Table 4 – Measured remanence factors	75
Table 5 – Various PR class definitions for the same core	80
Table 6 – e.m.f. definitions.....	81
Table 7 – Conversion of e.m.f. values	81
Table 8 – Conversion of dimensioning factors	82
Table 9 – Definitions of limiting current	82
Table 10 – Minimum requirements for class specification.....	83
Table 11 – Effect of gapped and non-gapped cores	84
Table 12 – Application recommendations	85
Table 13 – Calculation results of the overdimensioning of a TPY core	104
Table 14 – Calculation results of overdimensioning as PX core.....	104
Table 15 – Calculation scheme for line differential protection.....	111
Table 16 – Busbar protection scheme with two incoming feeders	119



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IEC TR 61869-100, which is a technical report, has been prepared by IEC technical committee 38: Instrument transformers.

The text of this technical report is based on the following documents:

Enquiry draft	Report on voting
38/469/DTR	38/475A/RVC

Full information on the voting for the approval of this technical report can be found in the report on voting indicated in the above table.

This publication has been drafted in accordance with the ISO/IEC Directives, Part 2.

A list of all the parts in the IEC 61869 series, published under the general title *Instrument transformers*, can be found on the IEC website.

The committee has decided that the contents of this publication will remain unchanged until the stability date indicated on the IEC web site under "http://webstore.iec.ch" in the data related to the specific publication. At this date, the publication will be

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INTRODUCTION

Since the publication of IEC 60044-6:1992¹, *Requirements for protective current transformers for transient performance*, the area of application of this kind of current transformers has been extended. As a consequence, the theoretical background for the dimensioning according to electrical requirements has become much more complex. For IEC 61869-2 to remain as user-friendly as possible, the explanation of the background information has been transferred to this part of IEC 61869.

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¹ Withdrawn and replaced by IEC 61869-2:2012.

INSTRUMENT TRANSFORMERS –

Part 100: Guidance for application of current transformers in power system protection

1 Scope

This part of IEC 61869 is applicable to inductive protective current transformers meeting the requirements of the IEC 61869-2 standard.

It may help relay manufacturers, CT manufacturers and project engineers to understand how a CT responds to simplified or standardized short circuit signals. Therefore, it supplies advanced information to comprehend the definition of inductive current transformers as well as their requirements.

The document aims to provide information for the casual user as well as for the specialist. Where necessary, the level of abstraction is mentioned in the document. It also discusses the question about the responsibilities in the design process for current transformers.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

IEC 60255 (all parts), *Measuring relays and protection equipment*

IEC 60909-0:2016, *Short circuit currents in three-phase a.c. systems – Calculation of currents*

IEC 61869-1:2007, *Instrument transformers – General requirements*

IEC 61869-2:2012, *Instrument transformers – Additional requirements for current transformers*

3 Terms and definitions and abbreviations

3.1 Terms and definitions

For the purposes of this document, the terms and definitions given in IEC 61869-1:2007 and IEC 61869-2:2012 and the following apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

- IEC Electropedia: available at <http://www.electropedia.org/>
- ISO Online browsing platform: available at <http://www.iso.org/obp>

3.1.1

rated primary short circuit current

I_{psc}

r.m.s. value of the a.c. component of a transient primary short-circuit current on which the accuracy performance of a current transformer is based

[SOURCE: IEC 61869-2:2012, 3.3.206]

3.1.2 rated short-time thermal current

 I_{th}

maximum value of the primary current which a transformer will withstand for a specified short time without suffering harmful effects, the secondary winding being short-circuited

[SOURCE: IEC 60050-321:1986, 321-02-22; IEC 61869-2:2012, 3.3.203]

3.1.3 initial symmetrical short circuit current

 I''_k

r.m.s. value of the a.c. symmetrical component of a prospective (available) short-circuit current, applicable at the instant of short circuit if the impedance remains at zero-time value

[SOURCE: IEC 60909-0:2001, 1.3.5]

Note 1 to entry: While I_{th} is a basic parameter of a plant and of its components, I_{psc} is an accuracy requirement, and has a determining influence on the saturation behaviour of a current transformer. The protection system will ensure tripping at a current I''_k , which is usually lower than I_{th} . Depending on the protection requirement, a current transformer may saturate much before reaching I''_k . Therefore, in certain cases, I_{psc} may be much lower than I''_k .

3.1.4 primary current

 I_p

current flowing through the primary winding of a current transformer

3.1.5 secondary current

 I_s

current flowing through the secondary winding of a current transformer

3.1.6 angular frequency

 ω

angular frequency of the primary current

3.1.7 time

 t

time

3.1.8 phase angle of the system short circuit impedance

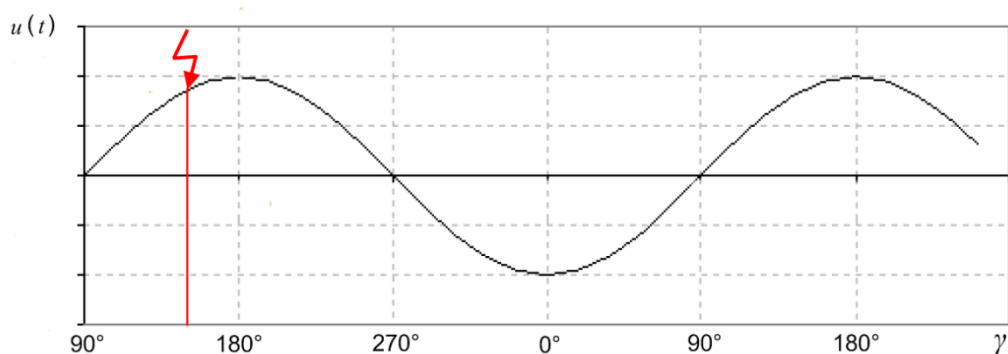
 φ

phase angle of the system short circuit impedance

3.1.9 fault inception angle

 γ

inception angle of the primary short circuit, being 180° at voltage maximum (see Figure 1)



Key

- u primary voltage
- γ fault inception angle

Figure 1 – Definition of the fault inception angle γ

3.1.10 minimum fault inception angle

γ_m
lowest value of fault inception angle γ to be considered in the design of a current transformer

3.1.11 alternative definition of fault inception angle

θ
inception angle of the primary short circuit, defined as $\gamma - \varphi$

3.2 Index of abbreviations

This table comprises Table 3.7 of IEC 61869-2:2012, complemented with the terms and definitions given in 3.1.1 to 3.1.11.

AIS	Air-Insulated Switchgear
ALF	Accuracy limit factor
CT	Current Transformer
CVT	Capacitive Voltage Transformer
E_{al}	rated equivalent limiting secondary e.m.f.
E_{ALF}	secondary limiting e.m.f. for class P and PR protective current transformers
E_{FS}	secondary limiting e.m.f. for measuring current transformers
E_k	rated knee point e.m.f.
f	frequency
F	mechanical load
F_c	factor of construction
f_R	rated frequency
F_{rel}	relative leakage rate
FS	instrument security factor
GIS	Gas-Insulated Switchgear
I''_k	Initial symmetrical short circuit current
\hat{I}_{al}	peak value of the exciting secondary current at E_{al}
I_{cth}	rated continuous thermal current