

INTERNATIONAL STANDARD

NORME INTERNATIONALE



**Measuring relays and protection equipment –
Part 187-1: Functional requirements for differential protection – Restrained and
unrestrained differential protection of motors, generators and transformers**

**Relais de mesure et dispositifs de protection –
Partie 187-1: Exigences fonctionnelles pour la protection différentielle –
Protection différentielle avec et sans caractéristique de retenue des moteurs,
générateurs et transformateurs**



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CONTENTS

FOREWORD.....	11
1 Scope.....	13
2 Normative references	14
3 Terms and definitions	14
4 Specification of the function.....	18
4.1 General.....	18
4.2 Input energizing quantities/energizing quantities	19
4.2.1 General	19
4.2.2 Connections	19
4.3 Binary input signals.....	19
4.4 Functional logic.....	22
4.4.1 General	22
4.4.2 Phase biased differential protection	22
4.4.3 Biased restricted earth fault protection	24
4.4.4 Compensation of energizing quantities	25
4.4.5 Additional restraint or blocking methods	26
4.5 Binary output signals	27
4.5.1 General	27
4.5.2 Start (pick-up) signals.....	27
4.5.3 Operate (trip) signals.....	27
4.5.4 Other output signals	27
4.6 Additional influencing functions and conditions	27
4.6.1 General	27
4.6.2 Operation during CT saturation.....	28
4.6.3 Switch onto fault.....	28
4.6.4 Energizing quantity failure (CT supervision).....	28
4.6.5 Off-nominal frequency operation.....	28
4.6.6 Geomagnetically induced currents (GIC).....	28
5 Performance specification	29
5.1 General.....	29
5.2 Effective and operating ranges.....	29
5.3 Steady state accuracy tests in the effective range.....	29
5.3.1 General	29
5.3.2 Test related to the declared thermal withstand current.....	30
5.3.3 Basic characteristic accuracy.....	30
5.3.4 Ratio compensation accuracy	30
5.3.5 Phase (vector) compensation validity.....	31
5.3.6 Zero sequence compensation validity	31
5.3.7 Harmonic restraint basic accuracy	31
5.3.8 Basic accuracy of time delay settings	31
5.3.9 Disengage time.....	31
5.4 Dynamic performance in operating range	32
5.4.1 General	32
5.4.2 Typical operate time	32
5.4.3 Relay stability for external faults	32
5.4.4 Relay behaviour for internal fault preceded by an external fault	33
5.5 Stability during magnetizing inrush conditions.....	33

5.6	Stability during overexcitation conditions	33
5.7	Presence of harmonics on load	33
5.8	Performance during saturation of current transformers	33
5.9	Behaviour of differential protection with digital interface for the energizing quantities	34
6	Functional tests	34
6.1	General	34
6.2	Test related to the declared thermal withstand current	35
6.3	Steady state accuracy tests in effective range	35
6.3.1	General	35
6.3.2	Basic characteristic accuracy	37
6.3.3	Ratio (magnitude) compensation accuracy	44
6.3.4	Phase (vector) compensation validity	45
6.3.5	Zero sequence compensation validity	47
6.3.6	Harmonic restraint basic accuracy test under steady state conditions at nominal frequency	50
6.3.7	Accuracy related to time delay setting	52
6.3.8	Determination and reporting of the disengage time	54
6.4	Dynamic performance tests	55
6.4.1	General	55
6.4.2	Operate time for double infeed network model (restrained operation)	57
6.4.3	Operate time for double infeed network model (unrestrained operation)	68
6.4.4	Operate time for radial single infeed network model (restrained operation)	73
6.4.5	Operate time for radial single infeed network model (unrestrained operation)	86
6.4.6	Reporting of typical operate time	89
6.4.7	Stability for external faults	95
6.5	Relay behaviour for internal fault preceded by an external fault	112
6.5.1	General	112
6.5.2	Application specific considerations: transformer differential	112
6.5.3	Application specific considerations: biased restricted earth fault	115
6.5.4	Application specific considerations: generator differential	119
6.5.5	Reporting	122
6.6	Stability during inrush conditions	123
6.6.1	General	123
6.6.2	Application specific considerations: transformer differential	123
6.7	Stability during overexcitation conditions	128
6.7.1	General	128
6.7.2	Application specific considerations: transformer differential	128
6.8	Performance with load harmonics	133
6.8.1	General	133
6.8.2	Application specific considerations: transformer differential	133
6.8.3	Application specific considerations: generator or motor differential	137
6.8.4	Application specific considerations: biased restricted earth fault	140
6.8.5	Reporting	142
7	Documentation requirements	143
7.1	Type test report	143
7.2	Other user documentation	143

Annex A (informative) Examples of phase (vector) compensation and zero sequence compensation schemes.....	144
A.1 General.....	144
A.2 Y→d conversion.....	145
A.2.1 Current conversion	145
A.2.2 Three-phase fault at Y (star/wye) side	146
A.2.3 Phase-phase fault at Y (star/wye) side.....	147
A.2.4 Single-phase fault at Y (star/wye) side.....	147
A.2.5 Three-phase fault at delta side	148
A.2.6 Phase-phase fault at delta side.....	149
A.2.7 Single-phase fault at delta side.....	149
A.2.8 Ratio between start currents under different fault types	152
A.3 d→Y conversion.....	152
A.3.1 Current conversion	152
A.3.2 Three-phase fault at Y (star/wye) side	153
A.3.3 Phase-phase fault at Y (star/wye) side.....	153
A.3.4 Single-phase fault at Y (star/wye) side.....	153
A.3.5 Three-phase fault at delta side	154
A.3.6 Phase-phase fault at delta side.....	154
A.3.7 Single-phase fault at delta side.....	155
A.3.8 Ratio between start currents under different fault types	155
Annex B (normative) Calculation of mean, median and mode.....	156
B.1 Mean	156
B.2 Median.....	156
B.3 Mode	156
B.4 Example	156
Annex C (normative) CT requirements	157
C.1 General.....	157
C.2 Transformer differential protection	161
C.2.1 General	161
C.2.2 Fault 1	161
C.2.3 Fault 2.....	162
C.2.4 Fault 3	162
C.3 Transformer restricted earth fault protection	163
C.3.1 General	163
C.3.2 Fault 1	163
C.3.3 Fault 2.....	164
C.3.4 Fault 3	164
C.4 Generator differential protection.....	165
C.4.1 General	165
C.4.2 Fault 2.....	165
C.4.3 Criteria and additional conditions.....	166
C.5 Motor differential protection	166
C.5.1 General	166
C.5.2 Fault 1	166
C.5.3 Criteria and additional conditions.....	166
C.5.4 Start of motor, security case	167
C.5.5 Criteria and additional conditions.....	167
C.6 Reporting.....	167

Annex D (informative) CT saturation and influence on the performance of differential relays	168
Annex E (informative) Guidance on dimensioning of CTs for transformer differential protection	173
E.1 General.....	173
E.2 Example 1.....	174
E.2.1 General	174
E.2.2 Verification of CT1 – Internal fault	175
E.2.3 Verification of CT1 – External fault	175
E.2.4 Verification of CT2.....	176
E.3 Example 2.....	177
E.3.1 General	177
E.3.2 Dimensioning of CT1	178
E.3.3 Dimensioning of CT2	179
Annex F (informative) Examples of test procedures to determine CT sizing requirements for differential protection.....	181
F.1 General.....	181
F.2 Test data	183
F.2.1 General	183
F.2.2 Network model for CT requirement tests for the transformer differential protection	183
F.2.3 Network model for CT requirement tests for the transformer restricted earth fault protection.....	187
F.3 CT data and CT models	189
F.4 Test summary	197
Annex G (normative) Ramping methods for testing basic characteristic accuracy.....	199
G.1 General.....	199
G.2 Pre-fault condition.....	199
G.3 Pseudo-continuous ramp	199
G.4 Ramp of shots.....	201
Annex H (informative) Example of COMTRADE file for an evolving fault test case	203
Annex I (normative) Definition of fault inception angle.....	204
Bibliography.....	205
Figure 1 – Explanatory diagram for start time, operate time and disengage time	17
Figure 2 – Simplified biased differential functional block diagram.....	18
Figure 3 – Primary current reference direction	21
Figure 4 – Typical restrained element (biased) characteristic.....	23
Figure 5 – Typical unrestrained element characteristic.....	23
Figure 6 – Example of combined characteristic using restrained and unrestrained elements.....	24
Figure 7 – Basic error of the operating characteristic	30
Figure 8 – Example of an operating characteristic in the I_{DIFF}/I_{REST} plane with a tolerance band.....	37
Figure 9 – Test cases for differential characteristic basic accuracy	39
Figure 10 – Example of a differential characteristic with test lines "a" to "h"	40
Figure 11 – Machine differential protection	40
Figure 12 – Test sequence for basic characteristic accuracy.....	42

Figure 13 – Machine restricted earth fault protection.....	43
Figure 14 – Example for documenting the test results for differential relay characteristic	44
Figure 15 – Ratio (magnitude) compensation accuracy test	45
Figure 16 – Secondary three-phase and double-phase injection for Winding 1 (example)	46
Figure 17 – Secondary single-phase and three-phase injections for Winding 1 (example)	48
Figure 18 – Zero sequence current injection on the Y side of the transformer	49
Figure 19 – Zero sequence current injection on the delta side of the transformer	49
Figure 20 – Example of a rated frequency harmonic restraint characteristic with visualization of test lines	52
Figure 21 – Sequence of events for testing the disengage time.....	54
Figure 22 – Double infeed network model for operate time tests	57
Figure 23 – Test sequence for double infeed network model – Restrained operation (transformer).....	61
Figure 24 – Double infeed network model for operate time tests	62
Figure 25 – Test sequence for double infeed network model – Restrained operation (REF).....	65
Figure 26 – Double infeed network model for operate time tests	66
Figure 27 – Test sequence for double infeed network model – Restrained operation (generator).....	69
Figure 28 – Test sequence for double infeed network model – Unrestrained operation (transformer).....	72
Figure 29 – Single infeed network model for operate time tests	73
Figure 30 – Test sequence radial single infeed network model – Restrained operation	77
Figure 31 – Single infeed network model for operate time tests	78
Figure 32 – Test sequence for radial single infeed network – Restrained operation (generator).....	81
Figure 33 – Single infeed network model for operate time tests	82
Figure 34 – Test sequence for radial single infeed network – Restrained operation (motor).....	85
Figure 35 – Test sequence for radial single infeed network – Unrestrained operation	Error!
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Figure 36 – Example of distribution of the operate time for one application	92
Figure 37 – Operate time as a function of the off-nominal frequency values (effective range is the specified range of ± 10 % of nominal frequency).....	94
Figure 38 – Operate time as a function of the off-nominal frequency values (accuracy range beyond the specified range of ± 10 % of nominal frequency	95
Figure 39 – Double infeed network model for stability tests	96
Figure 40 – Sequence of fault injection for stability due to external faults (transformer)	99
Figure 41 – Double infeed network model for stability tests	100
Figure 42 – Sequence of fault injection for stability due to external faults (REF)	103
Figure 43 – Double infeed network model for stability tests	104
Figure 44 – Sequence of fault injection for stability due to external faults (generator)	107
Figure 45 – Double infeed network model for stability tests	108
Figure 46 – Sequence of fault injection for stability due to external faults (motor)	111

Figure 47 – Double infeed network model for internal fault preceded by an external fault....	112
Figure 48 – Double infeed network model for internal fault preceded by an external fault test	116
Figure 49 – Double infeed network model for internal fault preceded by an external fault test	119
Figure 50 – Power transformer inrush current waveform	124
Figure 51 – Comparison of waveforms	125
Figure 52 – Connection for the relay when current is injected from Y winding	126
Figure 53 – Connection for the relay when current is injected from delta winding	127
Figure 54 – Power transformer overexcitation current waveform injected from Y winding	129
Figure 55 – Overexcitation current waveform injected from delta winding.....	129
Figure 56 – Comparison of the waveforms injected from Y winding	130
Figure 57 – Comparison of the waveforms injected from delta winding.....	131
Figure 58 – Three-phase overexcitation current waveform injected from Y winding	132
Figure 59 – Three-phase overexcitation current waveform injected from delta winding.....	133
Figure 60 – Test with superimposed harmonics on load – Transformer protection	133
Figure 61 – Three-phase load current waveform on the Y side of the transformer with superimposed harmonics	137
Figure 62 – Three-phase load current waveforms on the delta side of the YNd1 transformer with superimposed harmonics	137
Figure 63 – Test with superimposed harmonics on load	138
Figure 64 – Test with superimposed harmonics on load – Restricted earth fault protection .	140
Figure A.1 – Example of a transformer.....	144
Figure A.2 – Current vectors	145
Figure A.3 – Three-phase injection at Y (star/wye) side	147
Figure A.4 – Phase-phase injection at Y (star/wye) side	147
Figure A.5 – Single-phase injection at Y (star/wye) side.....	148
Figure A.6 – Three-phase injection at delta side	149
Figure A.7 – Phase-phase injection at delta side.....	149
Figure A.8 – Internal single-phase fault at delta side with neutral grounding transformer in the system	150
Figure A.9 – Single-phase injection at delta side.....	150
Figure A.10 – External single-phase fault at delta side with neutral grounding transformer inside protected zone	151
Figure C.1 – Fault positions to be considered for specifying the CT requirements.....	160
Figure C.2 – Fault positions to be considered for transformer differential protection.....	161
Figure C.3 – Fault positions to be considered for the restricted earth fault protection.....	163
Figure C.4 – External fault position to be considered for the generator differential protection	165
Figure C.5 – Internal fault position to be considered for the motor differential protection....	166
Figure D.1 – Fault positions to be considered for specifying the CT requirements	170
Figure D.2 – Additional fault position to be considered in case of summation of currents	170
Figure E.1 – Transformer differential relay example 1	174
Figure E.2 – Transformer differential relay example 2	177
Figure F.1 – Network models and fault positions for transformer differential protection	184

Figure F.2 – Network models and fault positions for transformer restricted earth fault protection	187
Figure F.3 – Excitation characteristic for the high-remenance basic CT	191
Figure F.4 – Magnetization curve for the high-remenance type basic CT.....	193
Figure F.5 – Secondary current at the limit of saturation caused by the AC component with no remanent flux in the CT	194
Figure F.6 – Secondary current in case of maximum DC offset	194
Figure F.7 – Excitation characteristics for non-remenance and high-remenance type basic CTs	196
Figure F.8 – Magnetization curve for non-remenance type basic CTs.....	197
Figure G.1 – Secondary injected currents for the simulation of a through load of 30 %	200
Figure G.2 – Pseudo-continuous ramp in the restraining current – Differential current plane in the time domain.....	201
Figure G.3 – Ramp of shots showing differential step change and the time step	202
Figure G.4 – Ramp of shots with binary search algorithm.....	202
Figure I.1 – Graphical definition of fault inception angle.....	204
Table 1 – Example of effective and operating ranges of differential protection	29
Table 2 – Frequencies for steady state accuracy tests when the frequency effective range is equal to ± 5 % of nominal frequency.....	36
Table 3 – Frequencies for steady state accuracy tests when the frequency effective range is larger than ± 5 % of nominal frequency	36
Table 4 – Example frequencies for steady state accuracy tests when the frequency effective range is narrower than ± 5 % of nominal frequency.....	36
Table 5 – Test points for differential characteristic basic accuracy	38
Table 6 – Test lines on the differential characteristic (Figure 10)	39
Table 7 – Basic characteristic accuracy	43
Table 8 – Example of start ratios resulting from phase (vector) compensation	47
Table 9 – Example of start ratios resulting from zero sequence compensation	50
Table 10 – Test points for rated frequency harmonic restraint.....	51
Table 11 – Reporting example of test results for harmonic restraint basic accuracy test	52
Table 12 – Results of time delay tests	53
Table 13 – Reported time delay	53
Table 14 – Results of disengage time for all the tests	55
Table 15 – Frequencies for dynamic performance tests when the frequency operating range is equal to ± 10 % of nominal frequency.....	55
Table 16 – Frequencies for dynamic performance tests when the frequency operating range is wider than ± 10 % of nominal frequency	55
Table 17 – Example frequencies for dynamic performance tests when the frequency operating range is narrower than ± 10 % of nominal frequency	56
Table 18 – Double infeed network model	58
Table 19 – Source impedances for double infeed network model – Restrained operation (e.g. 50 Hz ± 10 % operating range).....	59
Table 20 – Double infeed network model	62
Table 21 – Source impedances for double infeed network model – Restrained operation (e.g. 50 Hz ± 10 % operating range).....	63
Table 22 – Double infeed network model	66

Table 23 – Source impedances for double infeed network model – Restrained operation (e.g. 50 Hz $\pm$ 10 % operating range).....	67
Table 24 – Source impedances for double infeed network model – Unrestrained operation (e.g. 60 Hz $\pm$ 10 % operating range).....	70
Table 25 – Single infeed network model.....	74
Table 26 – Source impedances for radial single infeed network model – Restrained operation (e.g. 50 Hz $\pm$ 10 % operating range).....	74
Table 27 – Single infeed network model.....	78
Table 28 – Source impedances for radial single infeed network model – Restrained operation (e.g. 50 Hz $\pm$ 10 % operating range).....	79
Table 29 – Single infeed network model.....	82
Table 30 – Source impedances for radial single infeed network model – Restrained operation (e.g. 50 Hz $\pm$ 10 % operating range).....	83
Table 31 – Source impedances for radial single infeed network model – Unrestrained operation (e.g. 60 Hz $\pm$ 10 % operating range).....	86
Table 32 – Fault statistics for typical operate time of transformer protection (nominal frequency only).....	89
Table 33 – Fault statistics for typical operate time of biased restricted earth fault protection (nominal frequency only).....	90
Table 34 – Fault statistics for typical operate time of generator protection (nominal frequency only).....	90
Table 35 – Fault statistics for typical operate time of motor protection (nominal frequency only).....	90
Table 36 – Operate time classes.....	91
Table 37 – Corresponding operate time classes.....	91
Table 38 – Number of operate times and percentage.....	92
Table 39 – Example of typical operate time at nominal frequency (mode, median, mean)	93
Table 40 – Examples of operate times (50 Hz nominal, CT configuration 500 A/1 A and 1 000 A/1 A, power transformer protection).....	94
Table 41 – Double infeed network model	96
Table 42 – Source impedances for double infeed network model stability tests (e.g. 50 Hz $\pm$ 10 % operating range)	97
Table 43 – Double infeed network model	100
Table 44 – Source impedances for double infeed network model stability tests (e.g. 50 Hz $\pm$ 10 % operating range)	101
Table 45 – Double infeed network model	104
Table 46 – Source impedances for double infeed network model stability tests (e.g. 50 Hz $\pm$ 10 % operating range)	105
Table 47 – Double infeed network model	108
Table 48 – Source impedances for double infeed network model stability tests (e.g. 50 Hz $\pm$ 10 % operating range)	109
Table 49 – Double infeed network model	113
Table 50 – Source impedances, fault resistances and pre-fault conditions for internal fault preceded by an external fault (e.g. for 50 Hz power system frequency).....	113
Table 51 – Double infeed network model	116
Table 52 – Source impedances, fault resistances and pre-fault conditions for internal fault preceded by an external fault tests (e.g. for 50 Hz power system frequency).....	117
Table 53 – Double infeed network model	120

Table 54 – Source impedances, fault resistances and pre-fault conditions for internal fault preceded by an external fault tests (e.g. for 50 Hz power system frequency).....	120
Table 55 – Operate time for internal fault preceded by an external fault and for internal fault when the relay always operated	122
Table 56 – Operate time for internal fault preceded by an external fault and for internal fault when the relay did not always operate.....	123
Table 57 – Coefficients of the inrush current waveforms	124
Table 58 – Nameplate data for test-transformers	125
Table 59 – Parameter k values.....	125
Table 60 – Coefficient of the overexcitation waveforms.....	130
Table 61 – Test data for the transformer	131
Table 62 – Transformer data for the superimposed harmonics on load test	134
Table 63 – Fundamental component of load current in pu	134
Table 64 – Harmonic content for superimposed harmonics on load test	134
Table 65 – Harmonic phase angles for superimposed harmonics on load test	134
Table 66 – Generator or motor data for the superimposed harmonics on load test	138
Table 67 – Harmonic phase angles for superimposed harmonics on load test	139
Table 68 – Transformer data for the superimposed harmonics on load test	141
Table 69 – Harmonic phase angles for superimposed harmonics on load test	141
Table A.1 – Transformer data	144
Table A.2 – Start currents under different fault types	152
Table A.3 – Start currents under different fault types	155
Table C.1 – Levels of remanent or remaining flux to be considered for external faults.....	159
Table C.2 – Levels of remanent or remaining flux to be considered for external faults when the difference of size between the CTs is limited	159
Table E.1 – Fault currents.....	174
Table E.2 – Fault currents.....	177
Table F.1 – Specification of test cases for the transformer differential protection – Internal and external faults with one saturated CT	185
Table F.2 – Specification of test cases for the transformer differential protection – External faults with two saturated CTs	186
Table F.3 – Example time constants with corresponding R/X ratios.....	186
Table F.4 – Specification of test cases for the transformer restricted earth fault protection – Internal and external faults with one saturated CT	188
Table F.5 – Specification of test cases for the transformer restricted earth fault protection – External faults with two saturated CTs	188
Table F.6 – Excitation characteristic data for the high-remanence basic CT	190
Table F.7 – Magnetization curve data for the high-remanence type basic CT	193
Table F.8 – Excitation characteristic data for the non-remanence type basic CT	196
Table F.9 – Magnetization curve data for non-remanence type CT	197
Table G.1 – Restraining and differential currents for different definitions of the restraining current.....	200
Table I.1 – Fault type and reference voltage	204

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IEC 60255-187-1 has been prepared by IEC technical committee 95: Measuring relays and protection equipment. It is an International Standard.

This document, together with IEC 60255-187-2 and IEC 60255-187-3, cancels and replaces IEC 60255-13. This document constitutes a technical revision.

This document includes the following significant technical changes with respect to IEC 60255-13:

- a) IEC 60255-13 has been significantly revised to follow the common structure of the functional standards for protection relays (IEC 60255-1xx series). IEC 60255-187-1 has been developed to address the restrained and unrestrained differential protection of motors, generators and transformers. The revisions include detailed description of the functions including the performance specification, testing and documentation requirements.

The text of this International Standard is based on the following documents:

FDIS	Report on voting
95/465/FDIS	95/471/RVD

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

The language used for the development of this International Standard is English.

This document was drafted in accordance with ISO/IEC Directives, Part 2, and developed in accordance with ISO/IEC Directives, Part 1 and ISO/IEC Directives, IEC Supplement, available at www.iec.ch/members_experts/refdocs. The main document types developed by IEC are described in greater detail at www.iec.ch/standardsdev/publications.

This International Standard contains attached files in COMTRADE file format. Configuration file: IEC 60255-187-1_External_Internal_YY0_50 Hz_4 kHz.CFG and data file: IEC 60255-187-1_External_Internal_YY0_50 Hz_4 kHz.DAT. These files are intended to be used as a complement and do not form an integral part of the document.

A list of all parts in the IEC 60255 series, published under the general title *Measuring relays and protection equipment*, can be found on the IEC website.

The committee has decided that the contents of this document will remain unchanged until the stability date indicated on the IEC website under webstore.iec.ch in the data related to the specific document. At this date, the document will be

- reconfirmed,
- withdrawn,
- replaced by a revised edition, or
- amended.

IMPORTANT – The "colour inside" logo on the cover page of this document indicates that it contains colours which are considered to be useful for the correct understanding of its contents. Users should therefore print this document using a colour printer.

MEASURING RELAYS AND PROTECTION EQUIPMENT –

Part 187-1: Functional requirements for differential protection – Restrained and unrestrained differential protection of motors, generators and transformers

1 Scope

This part of IEC 60255 specifies the minimum requirements for functional and performance evaluation of (longitudinal) differential protection designed for the detection of faults in ac motors, generators and transformers. This document also defines how to document and publish performance test results.

This document covers the differential protection function whose operating characteristic can be defined on a bias-differential plane. It includes specification of the protection function, measurement characteristics, compensation of energizing quantities, additional restraint or blocking methods (for overexcitation and magnetizing inrush), starting and time delay characteristics. This document also covers unrestrained differential protection functions traditionally combined with the restrained (biased) differential element to form a single differential relay.

This document defines the influencing factors that affect the accuracy under steady state conditions and performance characteristics during dynamic conditions. The test methodologies for verifying performance characteristics and accuracy are also included in this document.

This document also includes current transformer requirements for the protection functions.

The differential protection functions covered by this document are as follows:

	IEEE/ANSI C37.2 function numbers	IEC 61850-7-4 logical nodes
Transformer differential	87T	PDIF
Motor differential	87M	PDIF
Generator differential	87G	PDIF
Restricted earth fault (ground differential)	87N	PDIF
Inrush restraint or inrush blocking		PHAR
Overexcitation restraint or overexcitation blocking		PHAR

This document does not specify the functional description of additional features often associated with biased differential relays such as current transformer (CT) supervision (CTS), switch onto fault (SOTF) and detection of geo-magnetically induced currents (GIC).

This document does not cover differential relays designed for bus bar protection (including high impedance differential protection and low impedance differential protection) or line protection. Additionally, this document does not explicitly cover generator incomplete longitudinal differential protection, generator split-phase transverse differential protection, self-balancing or magnetic balanced protection scheme, differential protection of phase-shifting transformers, directional restricted earth fault protection, railway transformers, convertor transformers and reactors. However, the principles covered by this document can be extended to provide guidance on these applications.

The general requirements for measuring relays and protection equipment are defined in IEC 60255-1.

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 60255-1, *Measuring relays and protection equipment – Part 1: Common requirements*

IEC 61850-8-1, *Communication networks and systems for power utility automation – Part 8-1: Specific communication service mapping (SCSM) – Mappings to MMS (ISO 9506-1 and ISO 9506-2) and to ISO/IEC 8802-3*

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

IEC 61869-9, *Instrument transformers – Part 9: Digital interface for instrument transformers*

3 Terms and definitions

For the purposes of this document, the following terms and definitions 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

differential relay

measuring relay that is intended to respond to the difference of the phasors and/or instantaneous values between specified incoming and outgoing electric currents

[SOURCE: IEC 60050-447:2020, 447-01-40]

3.2

biased relay

measuring relay, the characteristic of which is changed by means of an electrical bias

[SOURCE: IEC 60050-447:2020, 447-01-37]

3.3

percentage relay

biased relay, the characteristic of which is changed according to a percentage relationship of given input energizing quantity(ies)

[SOURCE: IEC 60050-447:2020, 447-01-38]