

Prüfbericht
Test Report

Prüfbericht-Nr. / Test Report No.: TS1112-03
Ausgabedatum / Date of Issue: 2012-11-23

Thema / Subject:

Typprüfung Transformatorschutz SIPROTEC 5 - V02.00 / Ausgabe 01

Type test Transformer Protection SIPROTEC 5 - V02.00 / Edition 01

Die Prüfungen wurden durchgeführt von (Prüflaboratorium):
The tests were performed by (testing laboratory):

SIEMENS AG
Development
IC SG EA PRO D 6 2
Wernerwerkdam 5
D - 13629 Berlin

Die Prüfungen wurden durchgeführt für (Auftraggeber):
The tests were performed for (client):

SIEMENS AG
Products
IC SG EA PRO LM1
Humboldtstr. 59
D - 90459 Nürnberg

Dieser Prüfbericht besteht aus 106 Seiten.
This Test Report consists of 106 pages.

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version: 1.22

Prüfgegenstand:
Tested equipment
Multifunktionschutzgeräte SIPROTEC 5
Multifunction Protection Relays SIPROTEC 5
Produktgruppe: Transformatorschutz
Product group: Transformer Protection
TUT65, TUT66, TUT67 Firmware V02.00

Angewandte Vorschriften:
Tests are according to
IEC/EN 60255, VDE 0435, IEC/EN 60870-2-4, UL 608
EN 50263, IEC/EN 60266-26/26/27, IEC/EN 61080-6-2, IEC/EN 61000-6-4,
IEEE Std C37.50.412

- Durchgeführte Prüfungen:
Performed tests
- 1 Eigenschaften bei Referenzbedingungen
Properties at reference conditions
 - 2 Zustand nach Beanspruchung
State after stress
 - 3 Verhalten bei Einflussgrößen
Performance at influencing quantities
 - 4 Elektromagnetische Verträglichkeit
Electromagnetic compatibility
 - 5 Sicherheit
Safety

Prüfergebnis:
Test results
Das Gerät hat die Prüfungen bestanden. Nach Abschluss der Prüfungen waren die Eigenschaften unverändert und das Gerät voll funktionsfähig.
The equipment has successfully passed the type test. The equipment did not show any changes and was fully in order subsequent to these tests.

Angaben zur Konformität:
Information of Conformity
Das Produkt stimmt mit den Vorschriften folgender EG-Richtlinien überein
The product is in conformity with the provisions of the following EC directives
- Elektromagnetische Verträglichkeit - Electromagnetic Compatibility
[2004 / 108 / EC (EG) / 2007-07-26]
- Niederspannung - Low Voltage
[2006 / 95 / EC (EG) / 2007-01-18]

SIEMENS AG - IC SG EA PRO
Infrastructure & Cities Sector
Smart Grid Division
Energy Automation

Ort:
Place
IC SG EA PRO D 6 2
13629 Berlin (Siemensstadt)

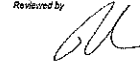
Datum:
Date
2012-11-23

Prüfer:
Tested by
Holzhauer



Unterschrift - Signature

Geprüft:
Reviewed by
Rochow



Unterschrift - Signature

Protokollgliederung
Scope of protocol

Blattanzahl
Sum of sheets

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Gültigkeitsbereich
Range of validity

SIPROTEC 5 modular, Geräte / SIPROTEC 5 modular, devices:

Produktbezeichnung / Product designation

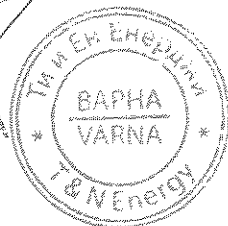
Grundgeräte / Basic devices

Distanzschutz / Distance Protection	7SA84, 7SA86, 7SA87
Differentialschutz / Differential Protection	7SD84, 7SD86, 7SD87
Leitungsschutz / Line Protection	7SL86, 7SL87
Schalter Management Gerät / Breaker Management Device	7VK87
Überstromzeitschutz / Overcurrent Protection	7SJ85, 7SJ86
Feldgerät / Bay Control Unit	6MD85, 6MD86
Transformatorschutz / Transformer Protection	7UT85, 7UT86, 7UT87
Bahnschutz / Railway Protection	7ST85
Störschreiber / Fault Recorder	7KE85
Motorschutz / Motor Protection	7SK85

Ersatzgeräte / Backup devices

Leitungsschutz / Line Protection	ESL84, ESL86, ESL87
Feldgerät / Bay Control Unit	EMD85, EMD86
Transformatorschutz / Transformer Protection	EUT87
Bahnschutz / Railway Protection	EST85
Überstromzeitschutz / Overcurrent Protection	ESJ85
Motorschutz / Motor Protection	ESK85

ВАРНО С
ОРИГИНАЛА



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Gültigkeitsbereich
Range of validity

SIPROTEC 5 Systembaukasten

Der SIPROTEC 5 Systembaukasten ist modular aufgebaut. Ein Gerät besteht immer aus einem Basismodul und optional aus Erweiterungsmodulen.

Die Module können nach hardware-seitigen Merkmalen ausgewählt werden. Diese Merkmale sind:

- Modulgröße
- Bauform
- Befestigung der Vor-Ort-Bedieneinheit
- Ausführung der Vor-Ort-Bedieneinheit
- Ein- und Ausgabebaugruppe
- Steckmodule

Die Module sind in 2 Größen erhältlich:

- Basismodul (1/3 von 19 Zoll)
- Erweiterungsmodul (1/6 von 19 Zoll)

Die Geräte sind in 3 Bauformen erhältlich:

- Einbaugeräte mit direkt am Gerät montierter Vor-Ort-Bedieneinheit
- Aufbaugeräte mit integrierter Vor-Ort-Bedieneinheit
- Aufbaugeräte mit abgesetzter Vor-Ort-Bedieneinheit

Die Vor-Ort-Bedieneinheiten der Basismodule sind aus 3 Varianten auswählbar:

- Mit großem Display, Tastatur und 16 2-farbigen Leuchtdioden
- Mit kleinem Display, Tastatur und 16 2-farbigen Leuchtdioden
- Ohne Display, ohne Tastatur (Standard), aber mit 16 2-farbigen Leuchtdioden

Die Vor-Ort-Bedieneinheiten der Erweiterungsmodule sind aus 3 Varianten auswählbar:

- Mit 16 einfarbigen Leuchtdioden und 2 Schlüsselschaltern
- Mit 16 einfarbigen Leuchtdioden
- Ohne Anzeigeelemente

Im Basismodul befindet sich immer die Stromversorgungsbaugruppe PS201 und eine Ein- und Ausgabebaugruppe IO203.

In den Erweiterungsmodulen befindet sich eine Ein- und Ausgabebaugruppe IO2XX¹ oder eine Steckmodul-Trägerbaugruppe mit integrierter Stromversorgung CB202.

Die Steckmodule sind für unterschiedliche Anwendungen verfügbar. Folgende Steckmodule können in ein Basismodul oder in ein Erweiterungsmodul mit einer Steckmodul-Trägerbaugruppe mit integrierter Stromversorgung CB202 eingebaut werden:

- Kommunikationsmodul
- Messumformermodul

¹ Siehe Blatt 0.2 - 4 „SIPROTEC 5 modular, Funktionsbeschreibung der Baugruppen und Steckmodule“

Gültigkeitsbereich
Range of validity

SIPROTEC 5 Modular System

The SIPROTEC 5 system is based on a modular structure. A device always consists of a base module and optionally of extension modules.

The modules can be selected according to hardware characteristics. These characteristics are:

- Module size
- Type of construction
- Mounting of the on-site operation panel
- Layout (or design) of the on-site operation panel
- Input and output module
- Plug-in modules

The modules are available in 2 sizes:

- Base module (1/3 of 19 in)
- Extension module (1/6 of 19 in)

The devices are available in 3 designs:

- Flush-mounting devices with on-site operation panel fitted directly on the device
- Surface-mounting devices with integrated on-site operation panel
- Surface-mounting devices with detached on-site operation panel

The on-site operation panels of the base modules can be selected from 3 variants:

- With a large display, keypad, and 16 2-colored LEDs
- With a small display, keypad, and 16 2-colored LEDs
- Without a display, without a keypad (standard), but with 16 2-colored LEDs

The on-site operation panels of the extension modules can be selected from 3 variants:

- With 16 1-colored LEDs and 2 key switches
- With 16 1-colored LEDs
- Without display elements

The base module always contains the power-supply module PS201 and an input and output module IO2XX¹. The extension module contains an input and output module IO203 or a plug-in module assembly with integrated power supply CB202.

The plug-in modules are available for various applications. The following plug-in modules can be installed in the base module or in an extension module with plug-in module assembly with integrated power supply CB202:

- Communication module
- Measuring-transducer module

¹ See page sheet 0.2 - 5 „SIPROTEC 5 modular, functional description of boards and plug-in modules“

Gültigkeitsbereich
Range of validity

Die Hardware Typprüfungen wurden an verschiedenen Kombinationen aller Module des SIPROTEC 5 Systembaukastens durchgeführt. Damit werden alle realisierten Gerätetypen abgedeckt.

SIPROTEC 5 modular,
Funktionsbeschreibung der Baugruppen und Steckmodule

Baugruppen-Bezeichnung	Funktionsbeschreibung
PS201	Stromversorgungsbaugruppe (DC: 24 V/48 V oder 60 V bis 250 V und AC: 115 V/230 V), im Basismodul (1/3 von 19 Zoll), bestückt mit 3 Binäreingängen, 2 Binärausgängen und einem Life-Kontakt
CB202	Steckmodul-Trägerbaugruppe mit integrierter Stromversorgung (DC: 24 V/48 V oder 60 V bis 250 V und AC: 115 V/230 V), im Erweiterungsmodul (1/6 von 19 Zoll)
CP200	Prozessorbaugruppe in der Frontkappe des Basismoduls (1/3 von 19 Zoll), verschiedene Varianten abhängig von der konstruktiven Geräteausführung
IO201	Ein- und Ausgabebaugruppe, 4 Strommessgänge, 8 Binäreingänge, 6 Binärausgänge, im Basis- oder Erweiterungsmodul, Bestückvariante der Baugruppe IO202
IO202	Ein- und Ausgabebaugruppe, 4 Strommessgänge, 4 Spannungsmessgänge, 8 Binäreingänge, 6 Binärausgänge, im Basis- oder Erweiterungsmodul
IO203	Ein- und Ausgabebaugruppe, 8 Strommessgänge, 4 Binäreingänge, 4 Binärausgänge, im Basis- oder Erweiterungsmodul
IO205	Ein- und Ausgabebaugruppe, 12 Binäreingänge, 16 Binärausgänge, im Erweiterungsmodul
IO206	Ein- und Ausgabebaugruppe, 6 Binäreingänge, 7 Binärausgänge, im Erweiterungsmodul, Bestückvariante der Baugruppe IO205
IO207	Ein- und Ausgabebaugruppe, 16 Binäreingänge, 8 Binärausgänge, Erweiterungsmodul
IO208	Ein- und Ausgabebaugruppe, 4 Strommessgänge, 4 Spannungsmessgänge, 4 Binäreingänge, 11 Binärausgänge, im Basis- oder Erweiterungsmodul
IO209	Ein- und Ausgabebaugruppe, 8 Binäreingänge, 4 schnelle Binärausgänge (halbleiterbeschleunigt), im Erweiterungsmodul
IO214	Ein- und Ausgabebaugruppe, 4 Strommessgänge, 4 Spannungsmessgänge, 2 Binäreingänge, 5 Binärausgänge, im Basis- oder Erweiterungsmodul, Bestückvariante der Baugruppe IO202
USART-xx ² -y ³ EL	Serial-Kommunikationsmodul mit elektrischer Übertragung
USART-xx ² -y ³ FO	Serial-Kommunikationsmodul mit optischer Übertragung für den Nahbereich
USART-xx ² -y ³ LDFO	Serial-Kommunikationsmodul mit optischer Übertragung für den Weitbereich
ETH-xx ² -y ³ EL	Ethernet-Modul mit elektrischer Übertragung
ETH-xx ² -y ³ FO	Ethernet-Modul mit optischer Übertragung
ANAI-CA-4EL	Messumformermodul

³ eindeutiger Code für das Modul im Produkt-Code des Schutzgerätes
² Ausführung: 1 = 1-Kanalig; 2 = 2-Kanalig

Gültigkeitsbereich
Range of validity

All hardware type tests were performed at various combinations with all modules of the SIPROTEC 5 platform. As a result all realized devices were covered:

SIPROTEC 5 modular,
functional description of boards and plug-in modules

Board name	Functional description
PS201	Power Supply module (DC: 24 V/48 V or 60 V to 250 V and AC: 115 V/230 V), mounted in 1/3 19-inch size housing, including 3 binary inputs, 2 binary outputs and one status life contact
CB202	Plug-in module assembly, including an additional power supply, (DC: 24 V/48 V or 60 V to 250 V and AC: 115 V/230 V), mounted in 1/6 19-inch size housing
CP200	Processor (CPU) module, mounted into the front cover of the 1/3 19-inch size housing, different variants for the available device designs
IO201	Input Output Board, 4 current inputs, 8 binary inputs, 6 binary outputs, reduced assembled variant of IO202
IO202	Input Output Board, 4 current measuring inputs, 4 voltage measuring inputs, 8 binary inputs, 6 binary outputs, mounted in 1/6 or 1/3 19-inch size housing
IO203	Input Output Board, 8 current measuring inputs, 4 binary inputs, 4 binary outputs, mounted in 1/6 19-inch size housing
IO205	Input Output Board, 12 binary inputs, 16 binary outputs, mounted in 1/6 19-inch size housing
IO206	Input Output Board, 6 binary inputs, 7 binary outputs, mounted in 1/6 19-inch size housing, reduced assembled variant of IO205
IO207	Input Output Board, 16 binary inputs, 8 binary outputs, mounted in 1/6 19-inch size housing
IO209	Input Output Board, 4 current measuring inputs, 4 voltage measuring inputs, 4 binary inputs, 11 binary outputs, mounted in 1/3 or 1/6 19-inch size housing
IO208	Input Output Board, 8 binary inputs, 4 High Speed Outputs, mounted in 1/6 19-inch size housing
IO214	Input Output Board, 4 current measuring inputs, 4 voltage measuring inputs, 2 binary inputs, 5 binary outputs, mounted in 1/6 or 1/3 19-inch size housing, reduced assembled variant of IO202
USART-xx ² -y ³ EL	Serial communication module, electrical connection
USART-xx ² -y ³ FO	Serial communication module, optical connection
USART-xx ² -y ³ LDFO	Serial communication module for long distances, optical connection
ETH-xx ² -y ³ EL	Ethernet module, electrical connection
ETH-xx ² -y ³ FO	Ethernet module, optical connection
ANAI-CA-4EL	Measuring-transducer module

³ unique code of the module in the product code of the device
² construction: 1 = 1 channel; 2 = 2 channels

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Ergänzungsübersicht
Scope of editions

Ausgabe Edition	Datum Date	Änderungen oder Ergänzungen gegenüber der vorangehenden Ausgabe Modifications or supplements compared to the former edition
01	2012-11-30	Erstausgabe, Firmware V02.00 First edition, Firmware V02.00

Unteraufträge
Subcontracting

Prüflaboratorium Testing laboratory	Kennzeichnung Marking
EMV Prüfungen: EMC Tests:	
PRO EMV Labor Strausberg (DAR: DAT-P-235/86-02) (DÄKKS: D-PL-12052-01-01) Garzauer Chaussee D - 15344 Strausberg	Report no.: PLE100502 PLE100621 PLE101213 PLE110116 PLE110117 PLE110501 PLE110025 PLE120513 PLE120803
Mechanische und Klimatische Prüfungen: Mechanical and climatic stress:	
AUCOTEAM GmbH Berlin (DAR: DAP-PL-3439.00) Storkower Str. 115 a D - 10407 Berlin	Report no.: P8777910 P8782810.01 P8832511 P8795209 P8715609 P8929112
RST Rail System Testing GmbH Umweltprüflabor (DAR: DAP-PL-1151.00) Am Rathaenapark D - 16761 Hennigsdorf	Report no.: P50-09-0057 P50-09-0102 P50-10-0111
TZO Labor für Umwelterprobung und Werkstoffprüfung (DAR: DAP-PL-2812.00) Hornstraße 5 D - 04249 Leipzig	Report no.: 151/10
Prüfung Transportverpackung Test transport packaging	
SCUS Servicecenter Umweltsimulation (DAR: DAP-PL-4267.00) Heidelberger Str. 20 D - 01189 Dresden	Report no.: 100415-01 100416-01
VDZ GmbH Kompetenz-Prüfzentrum für Verpackung und Transport (VDA authorized) Giselherstraße 34 D - 44319 Dortmund	Report no.: 060410

Sicherheitsprüfungen
Safety tests

IPps Institute for International Product Safety (listed in ALPHA and LOVAG register under Identity Number D 01) Prüflaboratorium Bonn Hahn-Moeller-Str. 7-11 D - 53115 Bonn	Report no.: 1001769 1001770 1001773 1001774 1001775 1001777
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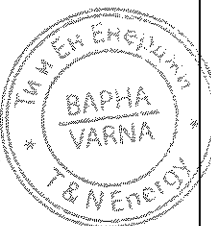
Analytische Materialprüfung
Analytic test of material

Prüflabor Helmut W. E. Lödemann Labor für instrumentelle Analytik Heinrich-Hertz-Str. 16 D - 23809 Ratzeburg	Report no.: 6829
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UL Zulassung
UL Certification

UL Germany Frankfurter Strasse 229 D-63263 Neu-Isenburg	Certificate no: 20101102-194016 Report Reference: E194016, volume 1, section 16
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ВЯРНО С
ОРИГИНАЛА



Informationsunterlagen; Technische Daten
Technical information; Technical data

Informationsunterlagen:
Technical information; Description:

	Handbuch Manual	Ausgabe Edition
1. SIPROTEC 5 Schutzgeräte Produktinformation	Bestell-Nr. C53000-B5000-C001-2	Deutsch German
2. SIPROTEC 5 Protection Devices Product Information	Part No. C53000-B5040-C001-3	Englisch English
3. SIPROTEC 5 Hardware Handbuch	Bestell-Nr. C53000-G5000-C002-2	Deutsch German
4. SIPROTEC 5 Hardware Manual	Part No. C53000-G5040-C002-3	Englisch English
5. SIPROTEC 5 Betrieb Handbuch	Bestell-Nr. C53000-G5000-C003-2	Deutsch German
6. SIPROTEC 5 Operating Manual	Part No. C53000-G5040-C003-2	Englisch English
7. SIPROTEC 5 Transformatorschutz 7UT85, 7UT86, 7UT87 Handbuch	Bestell-Nr. C53000-G5000-C016-1	Deutsch German
8. SIPROTEC 5 Transformer Protection 7UT85, 7UT86, 7UT87 Manual	Part No. C53000-G5040-C016-1	Englisch English

Die Technischen Daten sind enthalten in den Informationsunterlagen.
For the Technical Data see the description (Technical Information).

Zusammenfassung Summary

(Inhaltsverzeichnis) (Table of contents)

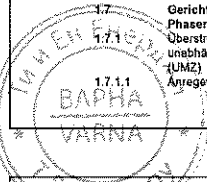
Table with 4 columns: Pos. Item, Prüfung, Test, Blatt Sheet. Includes sections like Allgemeines, Normen, Eigenschaften bei Referenzbedingungen, Erdfehlerdifferentialschutz, Externe Einkopplung, Überstromzeitschutz, etc.

Zusammenfassung Summary

(Inhaltsverzeichnis) (Table of contents)

Table with 4 columns: Pos. Item, Prüfung, Test, Blatt Sheet. Includes sections like Rückfallverhältnis, Anregezeiten, Verögerungszeiten, Überstromzeitschutz, etc.

ВЯРНО С
ОПРИКЛЮЧАТИ



Zusammenfassung Summary

(Inhaltsverzeichnis) (Table of contents)

Table with 4 columns: Pos. Item, Prüfung, Test, Blatt Sheet. Includes sections like Rückfallverhältnis, Anregezeiten, Verögerungszeiten, Überstromzeitschutz, etc.

Zusammenfassung Summary

(Inhaltsverzeichnis) (Table of contents)

Table with 4 columns: Pos. Item, Prüfung, Test, Blatt Sheet. Includes sections like Verögerungszeiten T, Gegensystemsenschutz, Hochstrom-Schnellabschaltung, etc.

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Table with 5 columns: Pos. Item, Prüfung, Zusammenfassung Summary, Test (Inhaltsverzeichnis), Blatt Sheet. Rows include Rückfallzeiten, Verzögerungszeiten, Frequenzschutz, Thermischer Überlastschutz, etc.

ВЯНО С
ОРИГИНАЛ

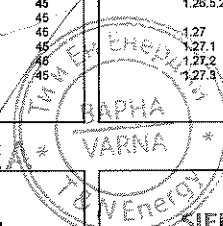


Table with 5 columns: Pos. Item, Prüfung, Zusammenfassung Summary, Test (Inhaltsverzeichnis), Blatt Sheet. Rows include Harmonische Is, Thermoboxen für die Temperaturfassung, etc.

Table with 5 columns: Pos. Item, Prüfung, Zusammenfassung Summary, Test (Inhaltsverzeichnis), Blatt Sheet. Rows include IEC 60870-5-103, Beanspruchung, Isolation, Belastbarkeit, etc.

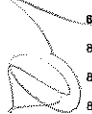
Table with 5 columns: Pos. Item, Prüfung, Zusammenfassung Summary, Test (Inhaltsverzeichnis), Blatt Sheet. Rows include Industrielatmosphäre, Mechanisch dynamische Beanspruchung, Einflussgrößen, etc.

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Zusammenfassung
Summary

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5.6.1	UL Zulassung	UL certification	83



Prüfungsposition Protocol Item	Prüfung Test	Prüfbedingungen Test conditions	Zulassungsbereich Approvals	Prüfgeräte Test devices	Testwerte Test values	Zulassungstoleranz Grenzwerte (lt. Techn. Daten) (Acc. to Techn. Data)	Prüfprotokoll Test report	Prüfprotokoll Bemerkungen Remarks
0	Allgemeines General	Bei anderen Verweirungen gilt nur die in Bezug genommenen Ausgabe für diesen Test. Vor dem Test muss die entsprechende Ausgabe der Norm zum Zeitpunkt der Typprüfung, für andere referenzen, only the edition/editions applies. For unlisted references, the currently published edition of the date of issue for this type test protocol applies.	Wenn nicht anders angegeben, beziehen sich alle Angaben/Referenzen über Angabe-Kennzeichnungen auf die Ausgabe der Norm (Typ F) über beschriebene Ausgabesätze (Type HS) können ca. 5 ms von den Zahlen substituiert werden.	Prüfgeräte: - Typ S = Standard Relais / standard relay - Typ F = Schmelze Relais / fast relay - Typ HS = High-Speed-Relais mit Halbleiterschaltung / High-Speed Relay with Semiconductor Accelerator	Prüfprotokoll: - COOT ¹ : 10 ms - COOT ² : 5 ms - COOT ³ : 1 ms	Bei anderen Verweirungen gilt nur die in Bezug genommenen Ausgabe für diesen Test. Vor dem Test muss die entsprechende Ausgabe der Norm zum Zeitpunkt der Typprüfung, für andere referenzen, only the edition/editions applies. For unlisted references, the currently published edition of the date of issue for this type test protocol applies.	Prüfprotokoll Bemerkungen	Prüfprotokoll Bemerkungen
0.1	Normen Standards							
0.2	Zellgruppen, Zellmessungen Time specifications and measurements		Releisgruppen Relay operating times					

COOT (cf. Pos. 5.6 Item 0.2)

Prüfungsposition Protocol Item	Prüfung Test	Prüfbedingungen Test conditions	Zulassungsbereich Approvals	Prüfgeräte Test devices	Testwerte Test values	Zulassungstoleranz Grenzwerte (lt. Techn. Daten) (Acc. to Techn. Data)	Prüfprotokoll Test report	Prüfprotokoll Bemerkungen Remarks
1	Eigenschaften bei Betriebsbedingungen Power characteristics at reference conditions	Leistungsannahme Power consumption	Leistungsannahme an den Anschlussstellen der Endgeräte Power input at the terminals of customer connections					
1.1								
1.1.1								
1.1.1.1								
1.1.1.2								
1.1.2								

COOT (cf. Pos. 5.6 Item 0.2)

Prüfungsposition Protocol Item	Prüfung Test	Prüfbedingungen Test conditions	Zulassungsbereich Approvals	Prüfgeräte Test devices	Testwerte Test values	Zulassungstoleranz Grenzwerte (lt. Techn. Daten) (Acc. to Techn. Data)	Prüfprotokoll Test report	Prüfprotokoll Bemerkungen Remarks
1.1.3	Hilfsspannung Auxiliary voltage	116 Steckmodul ohne Steckmodule ohne Steckmodule 118 Steckmodul ohne Steckmodule 119 Steckmodul ohne Steckmodule 120 Steckmodul ohne Steckmodule						
1.1.4	Blitzimpulse Lightning impulse							

COOT (cf. Pos. 5.6 Item 0.2)

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Prüfungsposition Protocol Item	Prüfung Test	Prüfbedingungen Test condition Operative range Specifications	Zulässige Toleranz Permissible Tolerance Limits (cf. Techn. Data)	Prüfprotokoll Remarks	Test result Remarks
1.3.3	Rückfallschaltzeit (I _{sc}) Dropout times (I _{sc})	Wie Pos./See Item 1.3.2	ca. 80 ms bei 50 Hz ca. 67 ms bei 60 Hz		<80 ms bei 50 Hz <67 ms bei 60 Hz
1.3.4	Vorzeitansprechen T (I _{sc}) Time delay T (I _{sc})	Zusätzlich zur Eigenzeit add to the inherent operating times	<1 % vom Einstellwert / of setting value bzw. / or 10 ms		<1 % vom Einstellwert / of setting value bzw. / or 10 ms
1.3.5	Rückfallschaltzeit (I _{sc}) Dropout times (I _{sc})	Wie Pos./See Item 1.3.1	ca. 0,70		0,68 ... 0,72
1.4	Externe Entschaltung External Trip Initiation				
1.4.1	Anschaltung Pickup Times	Soll Ansatz über I _{sc} oder Einphasenimpuls with initiation via I _{sc} / input signal	ca. 5 ms + ODT ¹⁾		ca. 5 ms + ODT ¹⁾
1.4.2	Rückfallschaltzeit Dropout Times	bei Ansatz über I _{sc} oder Einphasenimpuls with initiation via I _{sc} / input signal	ca. 3 ms + ODT ¹⁾		ca. 3 ms + ODT ¹⁾
1.4.3	Vorzeitansprechen Time Delays	Zusätzlich zur Eigenzeit add to the inherent operating times	<1 % vom Einstellwert / of setting value bzw. / or 10 ms		<1 % vom Einstellwert / of setting value bzw. / or 10 ms

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Prüfungsposition Protocol Item	Prüfung Test	Prüfbedingungen Test condition Operative range Specifications	Zulässige Toleranz Permissible Tolerance Limits (cf. Techn. Data)	Prüfprotokoll Remarks	Test result Remarks
1.2.1	Differenzialstrom (I _{sc}) Differential current (I _{sc})	VDE 0435 T3009/84 Abschaltstrom 3,5 I _n und/oder 4,5 IEC 60255-6 Abschaltstrom 13 und/oder 14	0,05 ≤ I _{sc} / I _{nom} ≤ 2,00		<2 % vom Einstellwert / of setting value
1.2.2	Hochstromstufe (I _{sc}) High-current stage (I _{sc})	Wie Pos./See Item 1.2.5	0,5 ≤ I _{sc} / I _{nom} ≤ 35,0		<2 % vom Einstellwert / of setting value
1.2.3	Anspruchverteilung beim Pickup am switch-on	1:0 bis 5:0	1:0 bis 5:0		Funktion in Ordnung / Function correct
1.2.4	Zustandshaltung bei externem Fehler Pick-up on switch-on	1:00 ≤ I _{sc} / I _{nom} ≤ 20,00 0,5 bis 5 Periodenzyklen oder / or n	0,5 bis 5 Periodenzyklen oder / or n		Funktion in Ordnung / Function correct

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Prüfungsposition Protocol Item	Prüfung Test	Prüfbedingungen Test condition Operative range Specifications	Zulässige Toleranz Permissible Tolerance Limits (cf. Techn. Data)	Prüfprotokoll Remarks	Test result Remarks
1.5	Überstromschutz 50/51, 50M/51N Overcurrent Protection	VDE 0435 IECEN 60255-151 Abschaltstrom I _{sc} Anhang Annex A, B	ca. 5 ms + ODT ¹⁾		<5 ms + ODT ¹⁾
1.5.1	Überstromschutz Präsentation mit unabhangiger Überstromerkennung (I _{sc}) Phases Ground with definite time overcurrent stages (definite time)	Phasen/Phases 3 I _{sc} bzw. I _{sc} (I _{sc} = 1 A) 3 I _{sc} gemessen/measured	<1 % vom Einstellwert / of setting value bzw. / or 25 ms (I _{sc} = 5 A)		<1 % vom Einstellwert / of setting value bzw. / or 25 ms (I _{sc} = 5 A)
1.5.1.1	Anspruchverteilung Pickup times	0,00 I _{sc} ≤ I _{sc} ≤ 100,00 I _{sc} (I _{sc} = 1 A) 0,15 I _{sc} ≤ I _{sc} ≤ 500,00 I _{sc} (I _{sc} = 5 A) 0,15 I _{sc} ≤ I _{sc} ≤ 500,00 I _{sc} (I _{sc} = 5 A)	ca. 0,30 I _{sc} + 30 ms (I _{sc} = 1 A) ca. 0,30 I _{sc} + 30 ms (I _{sc} = 5 A) ca. 0,30 I _{sc} + 30 ms (I _{sc} = 5 A)		ca. 0,30 I _{sc} + 30 ms (I _{sc} = 1 A) ca. 0,30 I _{sc} + 30 ms (I _{sc} = 5 A) ca. 0,30 I _{sc} + 30 ms (I _{sc} = 5 A)
1.5.1.2	Rückfallschaltzeit Dropout times	Wie Pos./See Item 1.5.1.1	ca. 0,30 I _{sc} (I _{sc} = 5 A)		ca. 0,30 I _{sc} (I _{sc} = 5 A)

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Prüfungsposition Protocol Item	Prüfung Test	Prüfbedingungen Test condition Operative range Specifications	Zulässige Toleranz Permissible Tolerance Limits (cf. Techn. Data)	Prüfprotokoll Remarks	Test result Remarks
1.2.5	Eigenzeit (I _{sc}) Operating times (I _{sc})	VDE 0435 T3009/84 Abschaltstrom 4,5 I _n und/oder 4,5 I _n	0,00 s ≤ T _{oper} ≤ 80,00 s		ca. 20 ms + ODT ¹⁾ bei 50 Hz ca. 20 ms + ODT ¹⁾ bei 60 Hz
1.2.6	Eigenzeit (I _{sc}) Operating times (I _{sc})	Wie Pos./See Item 1.2.5	0,00 s ≤ T _{oper} ≤ 80,00 s		ca. 8 ms + ODT ¹⁾ bei 50 Hz ca. 8 ms + ODT ¹⁾ bei 60 Hz
1.2.7	Rückfallschaltzeit (I _{sc}) Dropout times (I _{sc})	Wie Pos./See Item 1.2.5	0,00 s ≤ T _{oper} ≤ 80,00 s		ca. 20 ms + ODT ¹⁾ bei 50 Hz ca. 20 ms + ODT ¹⁾ bei 60 Hz
1.2.8	Verzögerung T (I _{sc}) Time delay T (I _{sc})	Zusätzlich zur Eigenzeit add to the inherent operating times	0,00 s ≤ T _{oper} ≤ 80,00 s		<1 % vom Einstellwert / of setting value bzw. / or 10 ms
1.2.9	Rückfallschaltzeit (I _{sc}) Dropout times (I _{sc})	Wie Pos./See Item 1.2.1 / 1.2.2	Wie Pos./See Item 1.2.1 / 1.2.2		ca. 0,70
1.3	Erfolgreiche Differenzialschutz Abschaltstrom 8/7N Restricted Earth Fault Protection (I _{sc})	VDE 0435 T3009/84 Abschaltstrom 3,5 I _n und/oder 4,5 IEC 60255-6 Abschaltstrom 13 und/oder 14	0,05 ≤ I _{sc} / I _{nom} ≤ 2,00		<2 % vom Einstellwert / of setting value bei I _{sc} ≤ 5 I _n
1.3.1	Differenzialstrom (I _{sc}) Differential current (I _{sc})	Wie Pos./See Item 1.2.1	0,05 ≤ I _{sc} / I _{nom} ≤ 2,00		<2 % vom Einstellwert / of setting value bei I _{sc} ≤ 5 I _n
1.3.2	Eigenzeit (I _{sc}) Operating times (I _{sc})	VDE 0435 T3009/84 Abschaltstrom 4,5 I _n und/oder 4,5 I _n	1,5 s Einstellwert (I _{sc}) 1,5 s setting value (I _{sc})		<17 ms + ODT ¹⁾ bei 50 Hz <17 ms + ODT ¹⁾ bei 60 Hz
1.3.3	Eigenzeit (I _{sc}) Operating times (I _{sc})	Wie Pos./See Item 1.3.2	2,5 s Einstellwert (I _{sc}) 2,5 s setting value (I _{sc})		<11 ms + ODT ¹⁾ bei 50 Hz <10 ms + ODT ¹⁾ bei 60 Hz

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Protokollposition Protocol Item	Prüfung Test	Prüfbedingung Attestation Specification	Prüfwerte Test values	Zulässige Toleranz Grenzwerte (v. Techn. Daten) Limiting values (Acc. to Techn. Data)	Prüfergebnis Remarks	Test result Remarks		
1.5.2.6	Rückfallzeit Dropout time	Wie Pos./See Item 1.5.2.1 (Typ/Type A)	Kommunikationsfehler/Tripzeit Communication error/Trip time	≤ 5% + 10 ms ≤ 5% + 10 ms	bestätigt / confirmed	bestätigt / confirmed		
1.5.2.5.1	IEC normal Inverters / IEC normal Inverters	Typ/Type A		≤ 5% + 10 ms ≤ 5% + 10 ms	bestätigt / confirmed	bestätigt / confirmed		
1.5.2.5.2	IEC start Inverters / IEC very Inverters	Typ/Type B		≤ 5% + 10 ms ≤ 5% + 10 ms	bestätigt / confirmed	bestätigt / confirmed		
1.5.2.5.3	IEC action Inverters / IEC extremely Inverters	Typ/Type C		≤ 5% + 10 ms ≤ 5% + 10 ms	bestätigt / confirmed	bestätigt / confirmed		
1.5.2.5.4	IEC longstart Inverters / IEC long-time Inverters	Typ/Type B		≤ 5% + 10 ms ≤ 5% + 10 ms	bestätigt / confirmed	bestätigt / confirmed		
1.5.2.5.5	ANSI Inverters / ANSI Inverters	Typ/Type B		≤ 5% + 10 ms ≤ 5% + 10 ms	bestätigt / confirmed	bestätigt / confirmed		
1.5.2.5.6	ANSI Inverters / ANSI Inverters	Typ/Type B		≤ 5% + 10 ms ≤ 5% + 10 ms	bestätigt / confirmed	bestätigt / confirmed		
1.5.2.5.7	ANSI Inverters / ANSI Inverters	Typ/Type B		≤ 5% + 10 ms ≤ 5% + 10 ms	bestätigt / confirmed	bestätigt / confirmed		
1.5.2.5.8	ANSI Inverters / ANSI Inverters	Typ/Type B		≤ 5% + 10 ms ≤ 5% + 10 ms	bestätigt / confirmed	bestätigt / confirmed		
1.5.2.5.10	ANSI Inverters / ANSI Inverters	Typ/Type B		≤ 5% + 10 ms ≤ 5% + 10 ms	bestätigt / confirmed	bestätigt / confirmed		
1.5.2.5.11	ANSI Inverters / ANSI Inverters	Typ/Type B		≤ 5% + 10 ms ≤ 5% + 10 ms	bestätigt / confirmed	bestätigt / confirmed		

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Protokollposition Protocol Item	Prüfung Test	Prüfbedingung Attestation Specification	Prüfwerte Test values	Zulässige Toleranz Grenzwerte (v. Techn. Daten) Limiting values (Acc. to Techn. Data)	Prüfergebnis Remarks	Test result Remarks		
1.5.2.6	Rückfallzeit Dropout time	Wie Pos./See Item 1.5.2.5 (Typ/Type A)	Kommunikationsfehler/Tripzeit Communication error/Trip time	≤ 5% + 10 ms ≤ 5% + 10 ms	bestätigt / confirmed	bestätigt / confirmed		
1.5.2.6.1	IEC normal Inverters / IEC normal Inverters	Typ/Type A		≤ 5% + 10 ms ≤ 5% + 10 ms	bestätigt / confirmed	bestätigt / confirmed		
1.5.2.6.2	IEC start Inverters / IEC very Inverters	Typ/Type B		≤ 5% + 10 ms ≤ 5% + 10 ms	bestätigt / confirmed	bestätigt / confirmed		
1.5.2.6.3	IEC action Inverters / IEC extremely Inverters	Typ/Type C		≤ 5% + 10 ms ≤ 5% + 10 ms	bestätigt / confirmed	bestätigt / confirmed		
1.5.2.6.4	IEC longstart Inverters / IEC long-time Inverters	Typ/Type B		≤ 5% + 10 ms ≤ 5% + 10 ms	bestätigt / confirmed	bestätigt / confirmed		
1.5.2.6.5	ANSI Inverters / ANSI Inverters	Typ/Type B		≤ 5% + 10 ms ≤ 5% + 10 ms	bestätigt / confirmed	bestätigt / confirmed		
1.5.2.6.6	ANSI Inverters / ANSI Inverters	Typ/Type B		≤ 5% + 10 ms ≤ 5% + 10 ms	bestätigt / confirmed	bestätigt / confirmed		
1.5.2.6.7	ANSI Inverters / ANSI Inverters	Typ/Type B		≤ 5% + 10 ms ≤ 5% + 10 ms	bestätigt / confirmed	bestätigt / confirmed		
1.5.2.6.8	ANSI Inverters / ANSI Inverters	Typ/Type B		≤ 5% + 10 ms ≤ 5% + 10 ms	bestätigt / confirmed	bestätigt / confirmed		
1.5.2.6.9	ANSI Inverters / ANSI Inverters	Typ/Type B		≤ 5% + 10 ms ≤ 5% + 10 ms	bestätigt / confirmed	bestätigt / confirmed		
1.5.2.6.10	ANSI Inverters / ANSI Inverters	Typ/Type B		≤ 5% + 10 ms ≤ 5% + 10 ms	bestätigt / confirmed	bestätigt / confirmed		
1.5.2.6.11	ANSI Inverters / ANSI Inverters	Typ/Type B		≤ 5% + 10 ms ≤ 5% + 10 ms	bestätigt / confirmed	bestätigt / confirmed		

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Protokollposition Protocol Item	Prüfung Test	Prüfbedingung Attestation Specification	Prüfwerte Test values	Zulässige Toleranz Grenzwerte (v. Techn. Daten) Limiting values (Acc. to Techn. Data)	Prüfergebnis Remarks	Test result Remarks		
1.5.1.3	Anregelzeit Pickup time	Wie Pos./See Item 1.5.1.1	$t_{in} = 1 \cdot t_{in} \cdot n^2$	25 ms + OOT ¹⁾ bei 50 Hz 22 ms + OOT ¹⁾ bei 60 Hz	bestätigt / confirmed	bestätigt / confirmed		
1.5.1.4	Rückfallzeit Dropout time	Wie Pos./See Item 1.5.1.1	Wie Pos./See Item 1.5.1.3	25 ms + OOT ¹⁾ bei 50 Hz 22 ms + OOT ¹⁾ bei 60 Hz	bestätigt / confirmed	bestätigt / confirmed		
1.5.1.5	Vorgangszeiten Time Delays	Zusätzlich zur Eigenzeit Added to the Inverse Operating Time	0.05 s bis / to 60.00 s	tr ca. / approx. 20 ms + OOT ¹⁾	bestätigt / confirmed	bestätigt / confirmed		
1.5.2	Überspannungsbetrieb Überstromschutz (AMS) Überstromschutz (AMS) Phase/Ground with Inverse time overcurrent stage (Inverse time)	Pfeilschutz Phase/Earth Überstromschutz (AMS) Überstromschutz (AMS) Phase/Ground with Inverse time overcurrent stage (Inverse time)	0.03 I _n > I _n < 100.00 I _n (n=1 A) 0.05 I _n > I _n < 500.00 I _n (n=5 A) 0.15 I _n > I _n < 100.00 I _n (n=1 A) 0.05 < T _p < 15.00	≤ 1% vom Einstellwert / of Setting Value bzw. / or 10 ms bzw. / or 25 mA (I _n =5 A)	bestätigt / confirmed	bestätigt / confirmed		

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Protokollposition Protocol Item	Prüfung Test	Prüfbedingung Attestation Specification	Prüfwerte Test values	Zulässige Toleranz Grenzwerte (v. Techn. Daten) Limiting values (Acc. to Techn. Data)	Prüfergebnis Remarks	Test result Remarks		
1.5.2.2	Rückfallzeit Dropout time	Wie Pos./See Item 1.5.2.1	Wie Pos./See Item 1.5.2.1	5% vom Einstellwert / of set point value oder / or 30 ms	bestätigt / confirmed	bestätigt / confirmed		
1.5.2.3	Anregelzeit Pickup time	Wie Pos./See Item 1.5.2.1	Wie Pos./See Item 1.5.2.1	5% vom Einstellwert / of set point value oder / or 30 ms	bestätigt / confirmed	bestätigt / confirmed		
1.5.2.4	Rückfallzeit Dropout time	Wie Pos./See Item 1.5.2.1	Wie Pos./See Item 1.5.2.3	5% vom Einstellwert / of set point value oder / or 30 ms	bestätigt / confirmed	bestätigt / confirmed		
1.5.2.4	Rückfallzeit Dropout time	Wie Pos./See Item 1.5.2.1	Wie Pos./See Item 1.5.2.3	5% vom Einstellwert / of set point value oder / or 30 ms	bestätigt / confirmed	bestätigt / confirmed		

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Prüfobjekt position Product Item	Prüfung Test	Prüfbedingungen Test condition Arbeitsbereich Operating range Vorschichten Specifications	Prüfwerte Test values	Zulässige Toleranz Gravimetre Limiting values (B. Techn. Daten) (Acc. to Techn. Data)	Prüfergebnis Test result Bemerkungen Remarks
1.6.1.2	Rücküberholzeit Dropout time	Wie Pos./See Item 1.6.1.1	Wie Pos./See Item 1.6.1.1	r ca. 0,95	
1.6.1.3	Anspruchzeit Pickup times	Wie Pos./See Item 1.6.1.1	$I_{th} = 2$	in ca. / approx. 15 ms * OOT ¹⁾ bei 60 Hz 14 ms * OOT ¹⁾ bei 50 Hz	
1.6.1.4	Rücküberholzeit Dropout times	Wie Pos./See Item 1.6.1.1	Wie Pos./See Item 1.6.1.3	r ca. / approx. 20 ms * OOT ¹⁾	
1.6.1.5	Vorausregeln Time Delay	Zusätzlich zur Element Submittal / Time del	0,00 s bis / to 60,00 s	<1% vom Einstellwert / of setting value bzw. / or 10ms	
1.6.2	Überstromschutz, 1-ph mit abschlagiger Überstromschutz (AMZ) Overcurrent Protection, 1-ph Phase/Ground with Inverse time overcurrent stage (Invers time)	1-phasig/1-phase			
1.6.2.1	Anspruchzeit Pickup values Messbereich = Grundschwingung / Method of measurement = fundamental components Messbereich = Effektivwert / Method of measurement = RMS value	D.03 I _{th} < I _p < 100.000 I _{th} (I _{th} =1 A) D.15 I _{th} < I _p < 500.00 I _{th} (I _{th} =5 A) Zählmultiplikator / Time del D.05 < T _{pe} < 15,00 D.03 I _{th} < I _p < 100.000 I _{th} (I _{th} =1 A) D.15 I _{th} < I _p < 500.00 I _{th} (I _{th} =5 A) Zählmultiplikator / Time del D.05 < T _{pe} < 15,00		$\leq 1\%$ vom Einstellwert / of setting value bzw. / or 5 mA (I _{th} =1 A) bzw. / or 25 mA (I _{th} =5 A)	
1) OOT (6 Pos./See Item 0.2)					

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Prüfobjekt position Product Item	Prüfung Test	Prüfbedingungen Test condition Arbeitsbereich Operating range Vorschichten Specifications	Prüfwerte Test values	Zulässige Toleranz Gravimetre Limiting values (B. Techn. Daten) (Acc. to Techn. Data)	Prüfergebnis Test result Bemerkungen Remarks
1.6.3	Überstromschutz, Phasen/Erde mit brennzahlschützender Kennlinie Overcurrent Protection, Phase/Ground with Inverse/Definite time characteristic	Phasen/Erde - 30 gemessen/messured - 30 gemessen/messured		$\leq 1\%$ vom Einstellwert / of setting value bzw. / or 5 mA (I _{th} =1 A) bzw. / or 25 mA (I _{th} =5 A)	
1.6.3.1	Anspruchzeit Pickup values Messbereich = Grundschwingung / Method of measurement = fundamental components	Wie Pos./See Item 1.6.3.1		Bt. 30: Harmonische / Up to 30 th harmonics $\leq 1\%$ vom Einstellwert / of setting value bzw. / or 5 mA (I _{th} =1 A) bzw. / or 25 mA (I _{th} =5 A)	
1.6.3.2	Rücküberholzeit Dropout ratio	Wie Pos./See Item 1.6.3.1	Wie Pos./See Item 1.6.3.1		bestätigt / confirmed
1.6.3.3	Anspruchzeit Pickup times	Wie Pos./See Item 1.6.3.1	Anspruchzeit für / Operate time for 2,5 If-Schwellwert < 20 / If-threshold value < 20		
1) OOT (6 Pos./See Item 0.2)					

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Prüfobjekt position Product Item	Prüfung Test	Prüfbedingungen Test condition Arbeitsbereich Operating range Vorschichten Specifications	Prüfwerte Test values	Zulässige Toleranz Gravimetre Limiting values (B. Techn. Daten) (Acc. to Techn. Data)	Prüfergebnis Test result Bemerkungen Remarks
1.6.2.2	Rücküberholzeit Dropout ratio	Wie Pos./See Item 1.6.2.1	Wie Pos./See Item 1.6.2.1	Disk-Emission / disk emission Unverzerrt / instantaneous	bestätigt / confirmed
1.6.2.3	Anspruchzeit Pickup times	Wie Pos./See Item 1.6.2.1	Anspruchzeit für / Operate time for 2,5 If-Schwellwert < 20 / If-threshold value < 20	5 % vom Einstellwert / of set point value oder / or +2 % Stromtoleranz / current tolerance oder / or 30 ms	bestätigt / confirmed
1.6.2.4	Rücküberholzeit unverzerrt / instantaneous Disk-Emission / disk emission	Wie Pos./See Item 1.6.2.1	Wie Pos./See Item 1.6.2.3	r ca. / approx. 20 ms * OOT ¹⁾	
1.6.2.5	Auslassschmelze Tipping time characteristic	Wie Pos./See Item 1.6.2.1	Rücküberholzeit für / Trip time for If-Schwellwert < 0,80 / If-threshold value < 0,80	5 % vom Einstellwert / of set point value oder / or 30 ms für / for 2 s If _{th} < 20 5 % ±15 ms für / for 2 s 300% < 20 5 % ±15 ms für / for 2 s 300% < 20	
1) OOT (6 Pos./See Item 0.2)					

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Prüfobjekt position Product Item	Prüfung Test	Prüfbedingungen Test condition Arbeitsbereich Operating range Vorschichten Specifications	Prüfwerte Test values	Zulässige Toleranz Gravimetre Limiting values (B. Techn. Daten) (Acc. to Techn. Data)	Prüfergebnis Test result Bemerkungen Remarks
1.6.3.4	Rücküberholzeit Dropout times unverzerrt / instantaneous Disk-Emission / disk emission	Wie Pos./See Item 1.6.3.1 Wie Pos./See Item 1.6.3.1	Wie Pos./See Item 1.6.3.3 Rücküberholzeit für / Operate time for If-Schwellwert < 0,80 / If-threshold value < 0,80	r ca. / approx. 20 ms * OOT ¹⁾ 5 % vom Einstellwert / of set point value oder / or +2 % Stromtoleranz / current tolerance oder / or 30 ms	
1.6	Überstromschutz 1-ph SOFT Overcurrent Protection 1-ph	VDE 0439 - IECEN 60954 - IECEN 60951-1 Abschaltung 1 - 1-phasig/1-phase	I _{th} = 50 Hz, 60 Hz		
1.6.1	Überstromschutz, Überstromschutz (AMZ) Overcurrent Protection, 1-phase with Definite time overcurrent stage (definite time)	1-phasig mit abschlagiger Überstromschutz (AMZ) 1-phasig/1-phase			
1.6.1.1	Anspruchzeit Pickup values Messbereich = Grundschwingung / Method of measurement = fundamental components Messbereich = Effektivwert / Method of measurement = RMS value	Wie Pos./See Item 1.6.3.1 D.03 I _{th} < I _p < 100.000 I _{th} (I _{th} =1 A) D.15 I _{th} < I _p < 500.00 I _{th} (I _{th} =5 A) D.03 I _{th} < I _p < 100.000 I _{th} (I _{th} =1 A) D.15 I _{th} < I _p < 500.00 I _{th} (I _{th} =5 A)		$\leq 1\%$ vom Einstellwert / of setting value bzw. / or 5 mA (I _{th} =1 A) bzw. / or 25 mA (I _{th} =5 A)	
1) OOT (6 Pos./See Item 0.2)					

SIEMENS Infrastructure & Cities Sector Smart Grid Division Energy Automation		TYPRÜFUNG - TYPE TEST Transformatorschutz V02.00 Transformer Protection V02.00		Zusammenfassung Summary		Ausgabe Edition 01 Datum Date 2012-11-23 Bericht Report TS1112-03 Blatt Sheet 0.6 - 1.6	
Protokoll position Protocol Item	Prüfung Test	Prüfbereich / Test condition / Anzeigebereich / Operative range / Verschlüsselung Specifications	Prüfwerte Test values	Zulassung / Tolerance / Grenzwerte / Limiting values / (B. Techn. Daten) (Acc. to Techn. Data)	Prüfergebnis / Test result / Bemerkungen / Remarks		
1.6.2.6.1	ANSI defint. Invers / ANSI definite Inverse	1-phasig / 1-phase			bestätigt / confirmed		
1.6.3	Überspannungsschutz, Iph mit Überstromfunktion / Overcurrent Protection, I-ph	0.030 I _{ph} ≤ I _p < 100.000 I _{ph} (I _{ph} = 1 A) 0.15 I _{ph} ≤ I _p < 500.000 I _{ph} (I _{ph} = 5 A) Zählmultiplikator / Time del. D.05 ≤ T _p ≤ 15.00			< 1 % vom Einstellwert / of setting value I _{ph} / or 25 mA (I _{ph} = 1 A) I _{ph} / or 25 mA (I _{ph} = 5 A)		
1.6.3.1	Antegrenze / Anteprove	0.030 I _{ph} ≤ I _p < 100.000 I _{ph} (I _{ph} = 1 A) 0.15 I _{ph} ≤ I _p < 500.000 I _{ph} (I _{ph} = 5 A) Zählmultiplikator / Time del. D.05 ≤ T _p ≤ 15.00			< 1 % vom Einstellwert / of setting value I _{ph} / or 25 mA (I _{ph} = 1 A) I _{ph} / or 25 mA (I _{ph} = 5 A)		
1.6.3.2	Rückstellzeit / Return time	0.030 I _{ph} ≤ I _p < 100.000 I _{ph} (I _{ph} = 1 A) 0.15 I _{ph} ≤ I _p < 500.000 I _{ph} (I _{ph} = 5 A) Zählmultiplikator / Time del. D.05 ≤ T _p ≤ 15.00			8h.30. Harmonische / Up to 30 th harmonics < 1 % vom Einstellwert / of setting value I _{ph} / or 25 mA (I _{ph} = 1 A) I _{ph} / or 25 mA (I _{ph} = 5 A)		
1.6.3.3	Arbeitszeit / Operating time	Wie Pos.see item 1.6.3.1	Ausschaltzeit für 2.4. I _{ph} Schwellwert ≤ 20 / Operate time for 2.4. I _{ph} threshold value ≤ 20		bestätigt / confirmed		
1.6.3.4	Rückfallzeit / Return time	Wie Pos.see item 1.6.3.1			8 ca. / approx. 20 ms → ODT ¹⁾		

1) ODT (L.Pros.2 item 0.2)

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Protokoll position Protocol Item	Prüfung Test	Prüfbereich / Test condition / Anzeigebereich / Operative range / Verschlüsselung Specifications	Prüfwerte Test values	Zulassung / Tolerance / Grenzwerte / Limiting values / (B. Techn. Daten) (Acc. to Techn. Data)	Prüfergebnis / Test result / Bemerkungen / Remarks		
1.6.2.5.1	IEC normal Invers / IEC normal Inverse	(Type A)			bestätigt / confirmed		
1.6.2.5.2	IEC stark Invers / IEC very Inverse	(Type B)			bestätigt / confirmed		
1.6.2.5.3	IEC extrem Invers / IEC extremely Inverse	(Type C)			bestätigt / confirmed		
1.6.2.5.4	IEC langzeit Invers / IEC long-time Inverse	(Type B)			bestätigt / confirmed		
1.6.2.5.5	ANSI langzeit Invers / ANSI long-time Inverse	(Type B)			bestätigt / confirmed		
1.6.2.5.6	ANSI kurzzeit Invers / ANSI short-time Inverse	(Type B)			bestätigt / confirmed		
1.6.2.5.7	ANSI extrem Invers / ANSI extremely Inverse	(Type B)			bestätigt / confirmed		

1) ODT (L.Pros.2 item 0.2)

SIEMENS Infrastructure & Cities Sector Smart Grid Division Energy Automation		TYPRÜFUNG - TYPE TEST Transformatorschutz V02.00 Transformer Protection V02.00		Zusammenfassung Summary		Ausgabe Edition 01 Datum Date 2012-11-23 Bericht Report TS1112-03 Blatt Sheet 0.6 - 1.9	
Protokoll position Protocol Item	Prüfung Test	Prüfbereich / Test condition / Anzeigebereich / Operative range / Verschlüsselung Specifications	Prüfwerte Test values	Zulassung / Tolerance / Grenzwerte / Limiting values / (B. Techn. Daten) (Acc. to Techn. Data)	Prüfergebnis / Test result / Bemerkungen / Remarks		
1.7	Geçektir / Overcurrent Protection, Phase	Wie Pos.see item 1.6.3.1	Rückfallzeit für I _{ph} Schwellwert ≤ 0.90 / Operate time for I _{ph} threshold value ≤ 0.90		bestätigt / confirmed		
1.7.1	Überspannungsschutz, Phasen mit unabhangiger Überstromfunktion (I _{ph}) / Overcurrent Protection, Phases with definite time measurement (definite time)	Wie Pos.see item 1.6.3.1	I _{ph} = 50 Hz, 60 Hz				
1.7.1.1	Antegrenze / Anteprove	0.030 I _{ph} ≤ I _p < 100.000 I _{ph} (I _{ph} = 1 A) 0.15 I _{ph} ≤ I _p < 500.000 I _{ph} (I _{ph} = 5 A) Zählmultiplikator / Time del. D.05 ≤ T _p ≤ 15.00			< 1 % vom Einstellwert / of setting value I _{ph} / or 25 mA (I _{ph} = 1 A) I _{ph} / or 25 mA (I _{ph} = 5 A)		
	Rückstellzeit / Return time	0.030 I _{ph} ≤ I _p < 100.000 I _{ph} (I _{ph} = 1 A) 0.15 I _{ph} ≤ I _p < 500.000 I _{ph} (I _{ph} = 5 A) Zählmultiplikator / Time del. D.05 ≤ T _p ≤ 15.00			8h.30. Harmonische / Up to 30 th harmonics < 1 % vom Einstellwert / of setting value I _{ph} / or 25 mA (I _{ph} = 1 A) I _{ph} / or 25 mA (I _{ph} = 5 A)		

1) ODT (L.Pros.2 item 0.2)

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Protokoll position Protocol Item	Prüfung Test	Prüfbereich / Test condition / Anzeigebereich / Operative range / Verschlüsselung Specifications	Prüfwerte Test values	Zulassung / Tolerance / Grenzwerte / Limiting values / (B. Techn. Daten) (Acc. to Techn. Data)	Prüfergebnis / Test result / Bemerkungen / Remarks		
1.6.2.5.8	ANSI stark Invers / ANSI very Inverse	(Type C)			bestätigt / confirmed		
1.6.2.5.9	ANSI extrem Invers / ANSI extremely Inverse	(Type C)			bestätigt / confirmed		
1.6.2.5.10	ANSI langzeit Invers / ANSI long-time Inverse	(Type B)			bestätigt / confirmed		
1.6.2.5.11	ANSI kurzzeit Invers / ANSI short-time Inverse	(Type B)			bestätigt / confirmed		
1.6.2.6	Rückfallzeit / Return time	Wie Pos.see item 1.6.2.5			≤ 5 % / 30 ms (I _{ph} = 0.90) ≤ 5 % / 30 ms (I _{ph} = 0.90)		
1.6.2.6.1	IEC normal Invers / IEC normal Inverse	(Type A)			bestätigt / confirmed		
1.6.2.6.2	IEC stark Invers / IEC very Inverse	(Type B)			bestätigt / confirmed		
1.6.2.6.3	IEC extrem Invers / IEC extremely Inverse	(Type C)			bestätigt / confirmed		
1.6.2.6.4	IEC langzeit Invers / IEC long-time Inverse	(Type B)			bestätigt / confirmed		
1.6.2.6.5	ANSI langzeit Invers / ANSI long-time Inverse	(Type B)			bestätigt / confirmed		
1.6.2.6.6	ANSI kurzzeit Invers / ANSI short-time Inverse	(Type B)			bestätigt / confirmed		
1.6.2.6.7	ANSI extrem Invers / ANSI extremely Inverse	(Type B)			bestätigt / confirmed		
1.6.2.6.8	ANSI stark Invers / ANSI very Inverse	(Type B)			bestätigt / confirmed		
1.6.2.6.9	ANSI normal Invers / ANSI normal Inverse	(Type C)			bestätigt / confirmed		
1.6.2.6.10	ANSI mittig Invers / ANSI moderately Inverse	(Type C)			bestätigt / confirmed		

1) ODT (L.Pros.2 item 0.2)

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Prüfobjekt-Position Product Item	Prüfung Test	Prüfbedingungen Abtastbereich Vorschaltflanz Specifications	Prüfwerte Test values	Zulässige Toleranz Grenzabweichung (B. Techn. Daten) Limiting values (Acc. to Techn. Data)	Prüfergebnis Bemerkungen Remarks
1.7.2.5	Ausfallschaltverhalten Tripping time characteristics	Wie Pos./See Item 1.7.2.1 (Typ/Type A)	Kommensurabel/Tripping times tk	≤ 5 % ±15 ms Butler 3 ± 15 ± 20	bestätigt / confirmed
1.7.2.5.1	IEC normal Invers / IEC normal Inverse	(Typ/Type A)			bestätigt / confirmed
1.7.2.5.2	IEC stark Invers / IEC very Inverse	(Typ/Type B)			bestätigt / confirmed
1.7.2.5.3	IEC action Invers / IEC extremely Inverse	(Typ/Type C)			bestätigt / confirmed
1.7.2.5.4	IEC langzeit Invers / IEC long-time Inverse	(Typ/Type B)			bestätigt / confirmed
1.7.2.5.5	ANSI langzeit Invers / ANSI long-time Inverse	(Typ/Type B)			bestätigt / confirmed
1.7.2.5.6	ANSI kurzzeit Invers / ANSI short-time Inverse	(Typ/Type B)			bestätigt / confirmed
1.7.2.5.7	ANSI extrem Invers / ANSI extremely Inverse	(Typ/Type C)			bestätigt / confirmed
1.7.2.5.8	ANSI stark Invers / ANSI very Inverse	(Typ/Type C)			bestätigt / confirmed
1.7.2.5.10	ANSI normal Invers / ANSI normal Inverse	(Typ/Type C)			bestätigt / confirmed
1.7.2.5.11	ANSI mäßig Invers / ANSI moderately Inverse	(Typ/Type A)			bestätigt / confirmed
1.7.2.5.11	ANSI defekt Invers / ANSI defective Inverse	(Typ/Type B)			bestätigt / confirmed
1.7.2.6	Rückfallverhalten Dropout characteristics	Wie Pos./See Item 1.7.2.1	Rückfallzeiten/Dropout times	≤ 5 % ±30 ms Butler 0.05 s / Is < 0.90	bestätigt / confirmed
1.7.2.6.1	IEC normal Invers / IEC normal Inverse	(Typ/Type A)			bestätigt / confirmed
1.7.2.6.2	IEC stark Invers / IEC very Inverse	(Typ/Type B)			bestätigt / confirmed

1.007 (B. Pos./See Item 0.2)

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Prüfobjekt-Position Product Item	Prüfung Test	Prüfbedingungen Abtastbereich Vorschaltflanz Specifications	Prüfwerte Test values	Zulässige Toleranz Grenzabweichung (B. Techn. Daten) Limiting values (Acc. to Techn. Data)	Prüfergebnis Bemerkungen Remarks
1.7.1.2	Rückfallverhalten Dropout ratio	Wie Pos./See Item 1.7.1.1	r = einstellbares Rückfallverhältnis 0.95 ≤ r ≤ 0.99	0.90 ≤ r ≤ 0.99 Butler ≤ 0.5 %	0.90 ≤ r ≤ 0.99 Butler ≤ 0.5 %
1.7.1.3	Anregelzeit Pickup times	Wie Pos./See Item 1.7.1.1	tk _{0.95} ≤ 2	tk ca. / approx. 25 ms + OOT ¹⁾ Butler 50 Hz 22 ms + OOT ¹⁾ Butler 60 Hz	tk ca. / approx. 25 ms + OOT ¹⁾ Butler 50 Hz 22 ms + OOT ¹⁾ Butler 60 Hz
1.7.1.4	Rückfallzeiten Dropout times	Wie Pos./See Item 1.7.1.1	tk _{0.95} ≤ 2	tk ca. / approx. 20 ms + OOT ¹⁾	tk ca. / approx. 20 ms + OOT ¹⁾
1.7.1.5	Verzögerungszeiten Time Delays	Zusätzlich bei Eigenstart Add to the inherent operating times	0.00 s bis / to 60.00 s	<1% vom Einstellwert / of setting value bzw. / or 10ms	<1% vom Einstellwert / of setting value bzw. / or 10ms
1.7.2	Überspannungsschutz; Überstromschutz (AMZ) Überstromschutz (AMZ) Phasen mit Inverse Limite overcurrent stage (inverse time)	Phasen / Phases			bestätigt / confirmed
1.7.2.1	Anregelzeit Pickup times Messverfahren = Grundschwingung Method of measurement = fundamental components	0.050 Is ≤ Is ≤ 100.000 Is (Is = 1 A) 0.15 Is ≤ Is ≤ 500.00 Is (Is = 5 A) Zählmultiplikator / Time dial 0.05 ≤ T ≤ 15.00		≤ 1 % vom Einstellwert / of setting value bzw. / or 5 mA (Is = 1 A) bzw. / or 25 mA (Is = 5 A)	bestätigt / confirmed

1.007 (B. Pos./See Item 0.2)

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Prüfobjekt-Position Product Item	Prüfung Test	Prüfbedingungen Abtastbereich Vorschaltflanz Specifications	Prüfwerte Test values	Zulässige Toleranz Grenzabweichung (B. Techn. Daten) Limiting values (Acc. to Techn. Data)	Prüfergebnis Bemerkungen Remarks
1.7.2.3	IEC action Invers / IEC extremely Inverse	(Typ/Type C)			bestätigt / confirmed
1.7.2.4	IEC langzeit Invers / IEC long-time Inverse	(Typ/Type B)			bestätigt / confirmed
1.7.2.5	ANSI langzeit Invers / ANSI long-time Inverse	(Typ/Type B)			bestätigt / confirmed
1.7.2.6	ANSI kurzzeit Invers / ANSI short-time Inverse	(Typ/Type B)			bestätigt / confirmed
1.7.2.7	ANSI extrem Invers / ANSI extremely Inverse	(Typ/Type C)			bestätigt / confirmed
1.7.2.8	ANSI stark Invers / ANSI very Inverse	(Typ/Type C)			bestätigt / confirmed
1.7.2.8	ANSI normal Invers / ANSI normal Inverse	(Typ/Type C)			bestätigt / confirmed
1.7.2.6.10	ANSI mäßig Invers / ANSI moderately Inverse	(Typ/Type A)			bestätigt / confirmed
1.7.2.6.11	ANSI defekt Invers / ANSI defective Inverse	(Typ/Type B)			bestätigt / confirmed
1.7.3	Überspannungsschutz; Phasen mit Inverse Limite Kurzschluss Overcurrent Protection; Phases with User-Defined Characteristics	Phasen / Phases			bestätigt / confirmed
1.7.3.1	Anregelzeit Pickup times Messverfahren = Grundschwingung Method of measurement = fundamental components	0.050 Is ≤ Is ≤ 100.000 Is (Is = 1 A) 0.15 Is ≤ Is ≤ 500.00 Is (Is = 5 A) Zählmultiplikator / Time dial 0.05 ≤ T ≤ 15.00		≤ 1 % vom Einstellwert / of setting value bzw. / or 5 mA (Is = 1 A) bzw. / or 25 mA (Is = 5 A)	< 1 % bzw. / or 1 % Is

1.007 (B. Pos./See Item 0.2)

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Prüfobjekt-Position Product Item	Prüfung Test	Prüfbedingungen Abtastbereich Vorschaltflanz Specifications	Prüfwerte Test values	Zulässige Toleranz Grenzabweichung (B. Techn. Daten) Limiting values (Acc. to Techn. Data)	Prüfergebnis Bemerkungen Remarks
1.7.2.2	Rückfallverhalten Dropout ratio	Wie Pos./See Item 1.7.2.1	tk _{0.95} ≤ 2	Bis 30 % harmonische / Up to 30% Harmonics ≤ 1 % vom Einstellwert / of setting value bzw. / or 5 mA (Is = 1 A) bzw. / or 25 mA (Is = 5 A)	bestätigt / confirmed
1.7.2.3	Anregelzeit Pickup times	Wie Pos./See Item 1.7.2.1	tk _{0.95} ≤ 2	Bis 30 % harmonische / Up to 30% Harmonics ≤ 1 % vom Einstellwert / of setting value bzw. / or 5 mA (Is = 1 A) bzw. / or 25 mA (Is = 5 A)	bestätigt / confirmed
1.7.2.4	Rückfallzeiten Dropout times Unverzögert / Instantaneous Disk-Emulsion / disk emulsion	Wie Pos./See Item 1.7.2.1	tk _{0.95} ≤ 2	5 % vom Sollwert / of set point value oder / or 42 % Stromabweichung / current tolerance delay or 30 ms	bestätigt / confirmed
1.7.3	Anregelzeit Pickup times Unverzögert / Instantaneous Disk-Emulsion / disk emulsion	Wie Pos./See Item 1.7.2.1	tk _{0.95} ≤ 2	5 % vom Sollwert / of set point value oder / or 42 % Stromabweichung / current tolerance delay / or 30 ms	bestätigt / confirmed

1.007 (B. Pos./See Item 0.2)

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Problem position / Problem/Item	Prüfung Test	Prüfbedingung / Antriebsbereich / Versuchsfall	Test values	Zulässige Toleranz / Grenzweite / (ll. Techn. Daten)	Permissible Tolerance / Limiting values / (Acc. to Techn. Data)	Prüfgabnis / Bemerkungen	Test result / Remarks
1.03.4 Rückfallzeiten / Dropout time / Unsuccessful / start emulsion / Disk-Emulsion / disk emulsion	Prüfung: Rückfallzeiten / Dropout time / Unsuccessful / start emulsion / Disk-Emulsion / disk emulsion	Prüfbedingung: We Pos./See Item 1.8.3.1 / We Pos./See Item 1.8.3.1	300-Schwellwert ≤ 0.90 / Operate time for 300th-threshold value ≤ 0.90	± ca. / approx. 20 ms ± OOT ¹⁾		ira. / approx. 20 ms ± OOT ¹⁾ bestätigt / confirmed	
1.03.4 Richtungsbestimmung / Directional determination	Prüfung: Richtungsbestimmung / Directional determination	Prüfbedingung: 180° < PN ≤ 180°	verschiedene Einstellwerte / various settings	±1°		<1°	
1.03.4 - Drehwinkel 4. Referenzspg. / - Rotation angle of ref. volt.	Prüfung: - Drehwinkel 4. Referenzspg. / - Rotation angle of ref. volt.	Prüfbedingung: 2.15 V/LU2 ≤ 20.0 V / 0.15V / ΔV2 ≤ 20.0 V	verschiedene Einstellwerte / various settings	±1%		<1%	
1.03.4 - Nennstrom Ia4. / - Nennwert sekund 4c.	Prüfung: - Nennstrom Ia4. / - Nennwert sekund 4c.	Prüfbedingung: 0° < PH ≤ 30°	verschiedene Einstellwerte / various settings	±1°		<1°	
1.03.4 Rücklaufbestimmung mit / Polarisation with	Prüfung: Rücklaufbestimmung mit / Polarisation with	Prüfbedingung: Nullzustand / zero sequence / Gegenstrom / negative sequence	verschiedene Einstellwerte / various settings				

1) OOT (s.Posit./Item.0.2)

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Problem position / Problem/Item	Prüfung Test	Prüfbedingung / Antriebsbereich / Versuchsfall	Test values	Zulässige Toleranz / Grenzweite / (ll. Techn. Daten)	Permissible Tolerance / Limiting values / (Acc. to Techn. Data)	Prüfgabnis / Bemerkungen	Test result / Remarks
1.02.5 ANSI normal Invers / ANSI normal Inverse	Prüfung: ANSI normal Invers / ANSI normal Inverse	Prüfbedingung: ANSI normal / (Typ-Type C)				bestätigt / confirmed	
1.02.5 ANSI midly Invers / ANSI moderately Inverse	Prüfung: ANSI midly Invers / ANSI moderately Inverse	Prüfbedingung: ANSI normal / (Typ-Type A)				bestätigt / confirmed	
1.02.5 ANSI defekt Invers / ANSI definite Inverse	Prüfung: ANSI defekt Invers / ANSI definite Inverse	Prüfbedingung: ANSI normal / (Typ-Type B)				bestätigt / confirmed	
1.02.5 Rückfallverhalten / Dropout characteristic	Prüfung: Rückfallverhalten / Dropout characteristic	Prüfbedingung: We Pos./See Item 1.7.2.1	Prüfbedingung / Antriebsbereich / Versuchsfall	± 5 % / 10 ms für 1000 / 0.05 s / 10 ms		bestätigt / confirmed	
1.02.5 IEC normal Invers / IEC normal Inverse	Prüfung: IEC normal Invers / IEC normal Inverse	Prüfbedingung: IEC normal / (Typ-Type A)				bestätigt / confirmed	
1.02.5 IEC stark Invers / IEC very Inverse	Prüfung: IEC stark Invers / IEC very Inverse	Prüfbedingung: IEC normal / (Typ-Type B)				bestätigt / confirmed	
1.02.5 IEC extrem Invers / IEC extremely Inverse	Prüfung: IEC extrem Invers / IEC extremely Inverse	Prüfbedingung: IEC normal / (Typ-Type C)				bestätigt / confirmed	
1.02.5 IEC Invers mit / IEC long-time Inverse	Prüfung: IEC Invers mit / IEC long-time Inverse	Prüfbedingung: IEC normal / (Typ-Type B)				bestätigt / confirmed	
1.02.5 ANSI langzeit Invers / ANSI long-time Inverse	Prüfung: ANSI langzeit Invers / ANSI long-time Inverse	Prüfbedingung: IEC normal / (Typ-Type B)				bestätigt / confirmed	
1.02.5 ANSI extrem Invers / ANSI extremely Inverse	Prüfung: ANSI extrem Invers / ANSI extremely Inverse	Prüfbedingung: IEC normal / (Typ-Type B)				bestätigt / confirmed	
1.02.5 ANSI stark Invers / ANSI very Inverse	Prüfung: ANSI stark Invers / ANSI very Inverse	Prüfbedingung: IEC normal / (Typ-Type B)				bestätigt / confirmed	
1.02.5 ANSI normal Invers / ANSI normal Inverse	Prüfung: ANSI normal Invers / ANSI normal Inverse	Prüfbedingung: IEC normal / (Typ-Type C)				bestätigt / confirmed	
1.02.5 ANSI multiphase Invers / ANSI multiphase Inverse	Prüfung: ANSI multiphase Invers / ANSI multiphase Inverse	Prüfbedingung: IEC normal / (Typ-Type C)				bestätigt / confirmed	
1.02.5 ANSI defekt Invers / ANSI definite Inverse	Prüfung: ANSI defekt Invers / ANSI definite Inverse	Prüfbedingung: IEC normal / (Typ-Type C)				bestätigt / confirmed	

1) OOT (s.Posit./Item.0.2)

SIEMENS
Infrastructure & Cities Sector
Smart Grid Division
Energy Automation

TYPRÜFUNG - TYPE TEST
Transformatorschutz V02.00
Transformer Protection V02.00

Ausgabe Edition 01
Datum Date 2012-11-23
Bericht Report TS1112-03
Blatt Sheet 0.6 - 31

Problem position / Problem/Item	Prüfung Test	Prüfbedingung / Antriebsbereich / Versuchsfall	Test values	Zulässige Toleranz / Grenzweite / (ll. Techn. Daten)	Permissible Tolerance / Limiting values / (Acc. to Techn. Data)	Prüfgabnis / Bemerkungen	Test result / Remarks
1.9 Schleiftschutz / # Unbalanced-Load Protection	Prüfung: Schleiftschutz / # Unbalanced-Load Protection	Prüfbedingung: VDE 0485 / IECEN 60255-1 / Abschnitt/Item 7 / Anhang/Annex A, B	I _{ph} = 50 Hz, 60 Hz	±3 % vom Einstellwert / of setting value / low. / or 3 mA (I _{ph} = 1 A) / low. / or 15 mA (I _{ph} = 5 A)		<3 % vom Einstellwert / of setting value / low. / or 3 mA (I _{ph} = 1 A) / low. / or 15 mA (I _{ph} = 5 A)	
1.9.1 Thermische Kennlinie / Thermal characteristic	Prüfung: Thermische Kennlinie / Thermal characteristic	Prüfbedingung: 3% - 12 - 30%	verschiedene Einstellwerte / various settings			Funktion in Ordnung / function correct	
1.9.2 Max. auswert. zustand / Max. continuous perm. / 2	Prüfung: Max. auswert. zustand / Max. continuous perm. / 2	Prüfbedingung: 1.0 s bis to 100.0 s	verschiedene Einstellwerte / various settings			Funktion in Ordnung / function correct	
1.9.3 Unsymmetrischer / Unbalance load factor / K	Prüfung: Unsymmetrischer / Unbalance load factor / K	Prüfbedingung: 0 s bis to 3000 s	verschiedene Einstellwerte / various settings			Funktion in Ordnung / function correct	
1.9.4 Abschaltchar. / Abort char.	Prüfung: Abschaltchar. / Abort char.	Prüfbedingung: Zuverlässig auf Eigenantrieb / Added to the Operating Times				<1 % vom Einstellwert / of setting value / low. / or 10 ms	
1.9.5 Vorgeschalteter / Pre-actuated	Prüfung: Vorgeschalteter / Pre-actuated	Prüfbedingung: 5.0 s ± 1% ± 99.9 %				<2 % vom Einstellwert / of setting value / oder / or 0.8 % absolute / absolute	
1.10 Gegensystemschutz mit unabh. / # Gegenüberstromschutz / (GUC)	Prüfung: Gegensystemschutz mit unabh. / # Gegenüberstromschutz / (GUC)	Prüfbedingung: VDE 0485 / IECEN 60255-1 / Abschnitt/Item 7 / Anhang/Annex A, B	I _{ph} = 50 Hz, 60 Hz			bestätigt / confirmed	
1.10.1 Annenwa / Annenwa	Prüfung: Annenwa	Prüfbedingung: VDE 0485 / IECEN 60255-1 / Abschnitt/Item 7 / Anhang/Annex A, B				bestätigt / confirmed	
1.10.1 Referenzwert / Referenzwert	Prüfung: Referenzwert	Prüfbedingung: VDE 0485 / IECEN 60255-1 / Abschnitt/Item 7 / Anhang/Annex A, B				bestätigt / confirmed	

1) OOT (s.Posit./Item.0.2)

SIEMENS
Infrastructure & Cities Sector
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TYPRÜFUNG - TYPE TEST
Transformatorschutz V02.00
Transformer Protection V02.00

Ausgabe Edition 01
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Problem position / Problem/Item	Prüfung Test	Prüfbedingung / Antriebsbereich / Versuchsfall	Test values	Zulässige Toleranz / Grenzweite / (ll. Techn. Daten)	Permissible Tolerance / Limiting values / (Acc. to Techn. Data)	Prüfgabnis / Bemerkungen	Test result / Remarks
1.8.3 Überstromschutz / 3R mit berührungsloser / Kontakt / Überstrom Protection / 3R with Non-Contact / Contactless	Prüfung: Überstromschutz / 3R mit berührungsloser / Kontakt / Überstrom Protection / 3R with Non-Contact / Contactless	Prüfbedingung: 3R					
1.8.3.1 Annenwa / Pickup value / Phasenphase / Messbereich = Grundschwingung / fundamentale / Phasenphase / Messbereich = 1. bis 15.00 / Zeitmultiplikator / Time delay / method of measurement = RMS	Prüfung: Annenwa / Pickup value / Phasenphase / Messbereich = Grundschwingung / fundamentale / Phasenphase / Messbereich = 1. bis 15.00 / Zeitmultiplikator / Time delay / method of measurement = RMS	Prüfbedingung: 0.003 I _{ph} ≤ 300 ≤ 100.000 I _{ph} (I _{ph} = 1 A) / 0.15 I _{ph} ≤ 300 ≤ 100.00 I _{ph} (I _{ph} = 5 A) / Zeitmultiplikator / Time delay / method of measurement = RMS				<1 % bzw. 0.1 % I _{ph} <1 % bzw. 0.1 % I _{ph}	
1.8.3.2 Rückfallverhalten / Dropout time	Prüfung: Rückfallverhalten / Dropout time	Prüfbedingung: We Pos./See Item 1.8.3.1				bestätigt / confirmed	
1.8.3.3 Annenzeit / Pickup times	Prüfung: Annenzeit / Pickup times	Prüfbedingung: We Pos./See Item 1.8.3.1				bestätigt / confirmed	

1) OOT (s.Posit./Item.0.2)

SIEMENS
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TYPPRÜFUNG - TYPE TEST
Transformatorerschutz V02.00
Transformer Protection V02.00

Problemposition Problem Item	Prüfung Test	Prüfbedingung Abtestbereich Specifications	Test condition Operative range Specifications	Prüfwerte Test values	Zulässige Toleranz Grenzwerte (U. Techn. Daten) Permissible Tolerance Limiting values (Acc. to Techn. Data)	Prüfergebnis Bemerkungen	Test result Remarks
1.10.2	beliebige Spannung / Any Voltage Up/ik Messverfahren / method of measurement = - Grundschwingung / fundamental components - - Effektivwert / RMS values Dropout ratio	0,300 V ≤ U _c ≤ U _p ≤ 340,000 V	-0,5 % vom Einstellwert / of setting value oder / or 0,5 V		±2 % vom Einstellwert / of setting value oder / or 4 % absolute / absolute	bestätigt / confirmed	
1.10.3	Rückstellverhältnis Dropout ratio	R = einstellbares Rückstellverhältnis variable dropout ratio 0,98 ≤ R ≤ 0,99			0,90 ≤ r ≤ 0,99	bestätigt / confirmed	
1.10.4	Arretierung Pickup times Rückabheben Dropout times	Wie Pos./See Item 1.10.1			in ca. / approx. 35 ms ± 0,07 s	bestätigt / confirmed	
1.10.5	Verzögerungszeiten Time Delays	Wie Pos./See Item 1.10.1			in ca. / approx. 35 ms ± 0,07 s	bestätigt / confirmed	
1.11	Arretierung Pickup times Rückabheben Dropout times Filtere über 2 Perioden / over 2 cycles	Wie Pos./See Item 1.12.1			≤1 % vom Einstellwert / of setting value bzw. / or 10ms	bestätigt / confirmed	
1.12	Arretierung Pickup times Rückabheben Dropout times Filtere über 2 Perioden / over 2 cycles	Wie Pos./See Item 1.12.1			≤5 % vom Einstellwert / of setting value bzw. / or 10 mA bei I _{lim} =1 A ≤5 % vom Einstellwert / of setting value bzw. / or 30 mA bei I _{lim} =5 A Funktion korrekter / Function correct	bestätigt / confirmed	
1.12.1	Arretierung Pickup times Rückabheben Dropout times Filtere über 2 Perioden / over 2 cycles	Wie Pos./See Item 1.12.1			≤5 % vom Einstellwert / of setting value bzw. / or 10 mA bei I _{lim} =1 A ≤5 % vom Einstellwert / of setting value bzw. / or 30 mA bei I _{lim} =5 A Funktion korrekter / Function correct	bestätigt / confirmed	

* 0,007 (6 Pos./See Item 0.2)

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Problemposition Problem Item	Prüfung Test	Prüfbedingung Abtestbereich Specifications	Test condition Operative range Specifications	Prüfwerte Test values	Zulässige Toleranz Grenzwerte (U. Techn. Daten) Permissible Tolerance Limiting values (Acc. to Techn. Data)	Prüfergebnis Bemerkungen	Test result Remarks
1.12.5	Arretierung Pickup times Rückabheben Dropout times Filtere über 2 Perioden / over 2 cycles	Zusätzlich zur Elementart Weiter für die Elementart		0,00 ± 0,02 Hz / 0,00 ± 0,02 s	≤1 % vom Einstellwert / of setting value bzw. / or 10ms	bestätigt / confirmed	
1.13	Arretierung Pickup times Rückabheben Dropout times Filtere über 2 Perioden / over 2 cycles	Wie Pos./See Item 1.12.1		0,00 ± 0,02 Hz / 0,00 ± 0,02 s	≤1 % vom Einstellwert / of setting value bzw. / or 10ms	bestätigt / confirmed	
1.13.1	Arretierung Pickup times Rückabheben Dropout times Filtere über 2 Perioden / over 2 cycles	Wie Pos./See Item 1.12.1		0,00 ± 0,02 Hz / 0,00 ± 0,02 s	≤1 % vom Einstellwert / of setting value bzw. / or 10ms	bestätigt / confirmed	
1.13.2	Arretierung Pickup times Rückabheben Dropout times Filtere über 2 Perioden / over 2 cycles	Wie Pos./See Item 1.12.1		0,00 ± 0,02 Hz / 0,00 ± 0,02 s	≤1 % vom Einstellwert / of setting value bzw. / or 10ms	bestätigt / confirmed	

* 0,007 (6 Pos./See Item 0.2)

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Problemposition Problem Item	Prüfung Test	Prüfbedingung Abtestbereich Specifications	Test condition Operative range Specifications	Prüfwerte Test values	Zulässige Toleranz Grenzwerte (U. Techn. Daten) Permissible Tolerance Limiting values (Acc. to Techn. Data)	Prüfergebnis Bemerkungen	Test result Remarks
1.10.2	beliebige Spannung / Any Voltage Up/ik Messverfahren / method of measurement = - Grundschwingung / fundamental components - - Effektivwert / RMS values Dropout ratio	0,300 V ≤ U _c ≤ U _p ≤ 340,000 V	-0,5 % vom Einstellwert / of setting value oder / or 0,5 V		±2 % vom Einstellwert / of setting value oder / or 4 % absolute / absolute	bestätigt / confirmed	
1.10.3	Rückstellverhältnis Dropout ratio	R = einstellbares Rückstellverhältnis variable dropout ratio 0,98 ≤ R ≤ 0,99			0,90 ≤ r ≤ 0,99	bestätigt / confirmed	
1.10.4	Arretierung Pickup times Rückabheben Dropout times	Wie Pos./See Item 1.10.1			in ca. / approx. 35 ms ± 0,07 s	bestätigt / confirmed	
1.10.5	Verzögerungszeiten Time Delays	Wie Pos./See Item 1.10.1			in ca. / approx. 35 ms ± 0,07 s	bestätigt / confirmed	
1.11	Arretierung Pickup times Rückabheben Dropout times Filtere über 2 Perioden / over 2 cycles	Wie Pos./See Item 1.12.1			≤1 % vom Einstellwert / of setting value bzw. / or 10ms	bestätigt / confirmed	
1.12	Arretierung Pickup times Rückabheben Dropout times Filtere über 2 Perioden / over 2 cycles	Wie Pos./See Item 1.12.1			≤5 % vom Einstellwert / of setting value bzw. / or 10 mA bei I _{lim} =1 A ≤5 % vom Einstellwert / of setting value bzw. / or 30 mA bei I _{lim} =5 A Funktion korrekter / Function correct	bestätigt / confirmed	
1.12.1	Arretierung Pickup times Rückabheben Dropout times Filtere über 2 Perioden / over 2 cycles	Wie Pos./See Item 1.12.1			≤5 % vom Einstellwert / of setting value bzw. / or 10 mA bei I _{lim} =1 A ≤5 % vom Einstellwert / of setting value bzw. / or 30 mA bei I _{lim} =5 A Funktion korrekter / Function correct	bestätigt / confirmed	

* 0,007 (6 Pos./See Item 0.2)

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Problemposition Problem Item	Prüfung Test	Prüfbedingung Abtestbereich Specifications	Test condition Operative range Specifications	Prüfwerte Test values	Zulässige Toleranz Grenzwerte (U. Techn. Daten) Permissible Tolerance Limiting values (Acc. to Techn. Data)	Prüfergebnis Bemerkungen	Test result Remarks
1.11.4	Arretierung Pickup times Rückabheben Dropout times	Zusätzlich zur Elementart Weiter für die Elementart		0,00 ± 0,02 Hz / 0,00 ± 0,02 s	≤1 % vom Einstellwert / of setting value bzw. / or 10ms	bestätigt / confirmed	
1.12	Arretierung Pickup times Rückabheben Dropout times Filtere über 2 Perioden / over 2 cycles	Wie Pos./See Item 1.12.1		0,00 ± 0,02 Hz / 0,00 ± 0,02 s	≤1 % vom Einstellwert / of setting value bzw. / or 10ms	bestätigt / confirmed	
1.12.1	Arretierung Pickup times Rückabheben Dropout times Filtere über 2 Perioden / over 2 cycles	Wie Pos./See Item 1.12.1		0,00 ± 0,02 Hz / 0,00 ± 0,02 s	≤1 % vom Einstellwert / of setting value bzw. / or 10ms	bestätigt / confirmed	

* 0,007 (6 Pos./See Item 0.2)

Protocol position / Prüfprotokoll Position	Prüfung / Test	Prüfbedingung / Anbahnbereich / Versuchsrichtung	Test condition / Operative range / Spezifikationen	Pflichten / Test values	Zulässige Toleranz / Grenzweite / Limiting values (A, B, Techn. Data)	Fremdeinsparnisse / Remarks
1.13.3	Arbeitszeiten Up/Down, U/V, U/W, ...	Wie Pos./See Item 1.13.1	200 s bis 60.000 s	≤ 1% vom Einstellwert / of setting value bzw. / or 5 mA (I _u = 1 A)	bestätigt / confirmed	
1.13.4	Rückstellzeiten Dropout times	Wie Pos./See Item 1.13.1	200 s bis 60.000 s	≤ 1% vom Einstellwert / of setting value bzw. / or 5 mA (I _u = 1 A)	bestätigt / confirmed	
1.13.5	Verzögerungszeiten Time Delays	Zusätzlich zur Eigenzeit Added to the inherent Operating Times	200 s bis 60.000 s	≤ 1% vom Einstellwert / of setting value bzw. / or 5 mA (I _u = 1 A)	< 1% vom Einstellwert / of setting value bzw. / or 10ms	
1.14	Eingipflerischer Erdfehlerschutz 57 Ms Sens. Ground Fault Protection	VDE 0435 IECEN 60255-1 Abschnitt 7	Zusätzlich zur Eigenzeit Added to the inherent Operating Times	0,001 I _n ≤ 3ID ≤ 100.000 I _n (I _n = 1 A) 0,005 I _n ≤ 3ID ≤ 500.000 I _n (I _n = 5 A)	< 1%	
1.14.1	Anzugsweite Pickup values	Messverfahren = Grundschaltung / method of measurement = fundamental components	0,001 I _n ≤ 3ID ≤ 1.000 I _n (I _n = 1 A) 0,005 I _n ≤ 3ID ≤ 5.000 I _n (I _n = 5 A)	< 1%	< 1%	
1.007 (s. Pos. z. Item 0.2)						

Protocol position / Prüfprotokoll Position	Prüfung / Test	Prüfbedingung / Anbahnbereich / Versuchsrichtung	Test condition / Operative range / Spezifikationen	Pflichten / Test values	Zulässige Toleranz / Grenzweite / Limiting values (A, B, Techn. Data)	Fremdeinsparnisse / Remarks
1.15	Gleichrichter Empfindlicher Erdschleucht 67 Ms Dir. Sens. Ground Fault Protection	VDE 0435 IECEN 60255-1 Abschnitt 7	0,001 I _n ≤ 3ID ≤ 100.000 I _n (I _n = 1 A) 0,005 I _n ≤ 3ID ≤ 500.000 I _n (I _n = 5 A)	≤ 1% vom Einstellwert / of setting value bzw. / or 5 mA (I _u = 1 A)	< 1%	
1.15.1	30 ms bis 60 s v. v. Messung Measurement		0,001 I _n ≤ 3ID ≤ 1.000 I _n (I _n = 1 A) 0,005 I _n ≤ 3ID ≤ 5.000 I _n (I _n = 5 A)	≤ 1% vom Einstellwert / of setting value bzw. / or 0,5 mA (I _u = 8 A)	< 1%	
1.15.1.1	Anzugsweite 30 Pickup values 30	Messverfahren = Grundschaltung / method of measurement = fundamental components	0,001 I _n ≤ 3ID ≤ 1.000 I _n (I _n = 1 A) 0,005 I _n ≤ 3ID ≤ 5.000 I _n (I _n = 5 A)	≤ 1% vom Einstellwert / of setting value bzw. / or 0,5 mA (I _u = 8 A)	< 1%	
1.15.1.2	Anzugsweite 30 Pickup values 30	Messverfahren = Grundschaltung / method of measurement = RMS	0,001 I _n ≤ 3ID ≤ 1.000 I _n (I _n = 1 A) 0,005 I _n ≤ 3ID ≤ 5.000 I _n (I _n = 5 A)	≤ 1% vom Einstellwert / of setting value bzw. / or 25 mA (I _u = 5 A)	< 1%	
1.15.1.3	Anzugsweite 30 Pickup values 30	Messverfahren = Grundschaltung / method of measurement = RMS	0,001 I _n ≤ 3ID ≤ 1.000 I _n (I _n = 1 A) 0,005 I _n ≤ 3ID ≤ 5.000 I _n (I _n = 5 A)	≤ 1% vom Einstellwert / of setting value bzw. / or 25 mA (I _u = 5 A)	< 1%	
1.15.1.4	Anzugsweite 30 Pickup values 30	Messverfahren = Grundschaltung / method of measurement = RMS	0,001 I _n ≤ 3ID ≤ 1.000 I _n (I _n = 1 A) 0,005 I _n ≤ 3ID ≤ 5.000 I _n (I _n = 5 A)	≤ 1% vom Einstellwert / of setting value bzw. / or 25 mA (I _u = 5 A)	< 1%	
1.15.1.5	Anzugsweite 30 Pickup values 30	Messverfahren = Grundschaltung / method of measurement = RMS	0,001 I _n ≤ 3ID ≤ 1.000 I _n (I _n = 1 A) 0,005 I _n ≤ 3ID ≤ 5.000 I _n (I _n = 5 A)	≤ 1% vom Einstellwert / of setting value bzw. / or 25 mA (I _u = 5 A)	< 1%	
1.15.1.6	Anzugsweite 30 Pickup values 30	Messverfahren = Grundschaltung / method of measurement = RMS	0,001 I _n ≤ 3ID ≤ 1.000 I _n (I _n = 1 A) 0,005 I _n ≤ 3ID ≤ 5.000 I _n (I _n = 5 A)	≤ 1% vom Einstellwert / of setting value bzw. / or 25 mA (I _u = 5 A)	< 1%	
1.15.1.7	Anzugsweite 30 Pickup values 30	Messverfahren = Grundschaltung / method of measurement = RMS	0,001 I _n ≤ 3ID ≤ 1.000 I _n (I _n = 1 A) 0,005 I _n ≤ 3ID ≤ 5.000 I _n (I _n = 5 A)	≤ 1% vom Einstellwert / of setting value bzw. / or 25 mA (I _u = 5 A)	< 1%	
1.15.2	Überspannungsschutz Stufe UP Measurables Protection Stage UP	Zusätzlich zur Eigenzeit Added to the inherent Operating Times	0,000 V ≤ UD ≤ 100,000 V	≤ 0,5 % vom Einstellwert / of setting value oder / or 0,5 V	< 0,5 % vom Einstellwert / of setting value oder / or 0,5 V	
1.15.2.1	Rückstellverhalten Dropout ratio	R = einstellbare Rückstellverhältnis settable dropout ratio	0,000 V ≤ UD ≤ 100,000 V	≤ 0,5 % vom Einstellwert / of setting value oder / or 0,5 V	bestätigt / confirmed	
1.007 (s. Pos. z. Item 0.2)						

Protocol position / Prüfprotokoll Position	Prüfung / Test	Prüfbedingung / Anbahnbereich / Versuchsrichtung	Test condition / Operative range / Spezifikationen	Pflichten / Test values	Zulässige Toleranz / Grenzweite / Limiting values (A, B, Techn. Data)	Fremdeinsparnisse / Remarks
3.10	Messverfahren = Effektivwert / method of measurement = RMS	Messverfahren = Effektivwert / method of measurement = RMS	0,001 I _n ≤ 3ID ≤ 100.000 I _n (I _n = 1 A) 0,005 I _n ≤ 3ID ≤ 500.000 I _n (I _n = 5 A)	≤ 1% vom Einstellwert / of setting value bzw. / or 5 mA (I _u = 1 A)	< 1%	
1.14.2	Rückstellverhalten Dropout ratio	R = einstellbare Rückstellverhältnis settable dropout ratio	0,001 I _n ≤ 3ID ≤ 1.000 I _n (I _n = 1 A) 0,005 I _n ≤ 3ID ≤ 5.000 I _n (I _n = 5 A)	≤ 1% vom Einstellwert / of setting value bzw. / or 0,5 mA (I _u = 8 A)	< 1%	
1.14.3	Anzugszeiten Pickup times	Zusätzlich zur Eigenzeit Added to the inherent Operating Times	200 s bis 60.000 s	≤ 1% vom Einstellwert / of setting value bzw. / or 5 mA (I _u = 1 A)	ca. 0,97	
1.14.4	Rückstellzeiten Dropout times	Zusätzlich zur Eigenzeit Added to the inherent Operating Times	200 s bis 60.000 s	≤ 1% vom Einstellwert / of setting value bzw. / or 5 mA (I _u = 1 A)	ca. 0,97	
1.14.5	Verzögerungszeiten Time Delays	Zusätzlich zur Eigenzeit Added to the inherent Operating Times	200 s bis 60.000 s	≤ 1% vom Einstellwert / of setting value bzw. / or 5 mA (I _u = 1 A)	ca. 0,97	
1.007 (s. Pos. z. Item 0.2)						

Protocol position / Prüfprotokoll Position	Prüfung / Test	Prüfbedingung / Anbahnbereich / Versuchsrichtung	Test condition / Operative range / Spezifikationen	Pflichten / Test values	Zulässige Toleranz / Grenzweite / Limiting values (A, B, Techn. Data)	Fremdeinsparnisse / Remarks
1.15.1.2	Anzugsweite UP Pickup values UP	3.000 V ≤ UD ≤ 100,000 V	0,000 V ≤ UD ≤ 100,000 V	≤ 1% vom Einstellwert / of setting value bzw. / or 0,5 V	< 1% vom Einstellwert / of setting value bzw. / or 0,5 V	
1.15.1.3	Kondensator des Meßkreises Angle capacitor	45° bis 100°	0,000 V ≤ UD ≤ 100,000 V	≤ 1% vom Einstellwert / of setting value bzw. / or 0,5 V	< 1% vom Einstellwert / of setting value bzw. / or 0,5 V	
1.15.1.4	Rückstellverhalten Dropout ratio	R = einstellbare Rückstellverhältnis settable dropout ratio	0,000 V ≤ UD ≤ 100,000 V	≤ 1% vom Einstellwert / of setting value bzw. / or 0,5 V	< 1% vom Einstellwert / of setting value bzw. / or 0,5 V	
1.15.1.5	Anzugszeiten Pickup times	Zusätzlich zur Eigenzeit Added to the inherent Operating Times	200 s bis 60.000 s	≤ 1% vom Einstellwert / of setting value bzw. / or 5 mA (I _u = 1 A)	ca. 0,97	
1.15.1.6	Rückstellzeiten Dropout times	Zusätzlich zur Eigenzeit Added to the inherent Operating Times	200 s bis 60.000 s	≤ 1% vom Einstellwert / of setting value bzw. / or 5 mA (I _u = 1 A)	ca. 0,97	
1.15.1.7	Verzögerungszeiten Time Delays	Zusätzlich zur Eigenzeit Added to the inherent Operating Times	200 s bis 60.000 s	≤ 1% vom Einstellwert / of setting value bzw. / or 5 mA (I _u = 1 A)	ca. 0,97	
1.15.2	Überspannungsschutz Stufe UP Measurables Protection Stage UP	Zusätzlich zur Eigenzeit Added to the inherent Operating Times	0,000 V ≤ UD ≤ 100,000 V	≤ 1% vom Einstellwert / of setting value bzw. / or 5 mA (I _u = 1 A)	ca. 0,97	
1.15.2.1	Rückstellverhalten Dropout ratio	R = einstellbare Rückstellverhältnis settable dropout ratio	0,000 V ≤ UD ≤ 100,000 V	≤ 1% vom Einstellwert / of setting value bzw. / or 5 mA (I _u = 1 A)	ca. 0,97	
1.007 (s. Pos. z. Item 0.2)						

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Protokollposition Protocol Item	Prüfung Test	Prüfbedingung Ableitbarbereich Voraussetzungen	Testwerte Test values	Zulässige Toleranz Grenzwerte (lt. Techn. Daten) (Acc. to Techn. Data)	Permissible Tolerance Limiting values (Acc. to Techn. Data)	Prüfergebnis Bemerkungen	Test result Remarks
1.17.2	Thermische Warmhalte Thermal warning stage	Wärmestufe 50 % <= 65 % <= 95 % <= 100 %				Funktion korrekt / Function correct	
1.17.3	Strommäßige Warmhalte Current warning stage	warm 0.03 I _{nom} / warm <= 100.00 % I _{nom}				Funktion korrekt / Function correct	
1.17.4	Rückfallverhalten Dropout threshold operate	Rückfallverhalten der Auslöseleitung / Dropout threshold operate 50 % bis zu 89 %				Funktion korrekt / Function correct	
1.17.5	Auslösestromhöhe Tripping time characteristic	k = I _{max} / (IEC 255-8) k = Zeitkonstante / Time constant 0.10 s <= k <= 4.00 0.10 s <= t <= 60.000 s I _{act} und I _{trip} konstant with and without preheat Sensitivität (I _{act} / I _{trip}) <= 8					
1.18	Allgemeiner Leistungschutz, 3-phasig 3-Phase General Power Protection, 3-Phase	V02.0435 - IECEN 60255-1 Abschütteln A, B Anfangstrom A, B					
1.18.1	Anregelwert Pickup values	200.0 % bis / to <= 200.0 % 49.0 % bis / to <= 49.0 %					
1.18.2	Nachregeln des Leistungsgeräts The power characteristic						
1.18.3	Rückfallverhalten Dropout rebt	0.90 bis / to 0.99 bei / at <= 50% / <= 50% 1.01 bis / to 1.10 bei / at <= 50% / <= 50% bei / at I _{act} = 50% bei / at I _{trip} = 60% bei / at I _{act} = 60%					
1.18.4	Anregelzeiten Pickup times	bei / at I _{act} = 50% bei / at I _{trip} = 60% bei / at I _{act} = 60%					
1.18.5	Rückfallzeiten (extern) Dropout times (external)	Zusätzlich zur Eigenzeit Added to the inherent opening time					
1.18.8	Verzögerungszeit Time Delay						
1.19	Drehfeldumkehrung Phase-Reversal Reversal						

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Protokollposition Protocol Item	Prüfung Test	Prüfbedingung Ableitbarbereich Voraussetzungen	Testwerte Test values	Zulässige Toleranz Grenzwerte (lt. Techn. Daten) (Acc. to Techn. Data)	Permissible Tolerance Limiting values (Acc. to Techn. Data)	Prüfergebnis Bemerkungen	Test result Remarks
1.15.2.2	Anregelzeiten Pickup times	Wie Po-Case Item 1.15.2 (Filter = Erhöhtwert / RMS value, Standardfilter / Standard Filter)				bestätigt / confirmed	
1.15.2.3	Rückfallzeiten Dropout times	Wie Po-Case Item 1.15.2 (Filter = über 2 Perioden / over 2 cycles)				bestätigt / confirmed	
1.15.2.4	Verzögerungszeiten Time Delays	Zusätzlich zur Eigenzeit Added to the inherent opening time	0.00 s bis / to 60.00 s			bestätigt / confirmed	
1.16	Frequenzschutze BF Frequency Protection	V02.0435 - IECEN 60255-1 Abschütteln 7					
1.16.1	Anregelwerte Pickup Values		40.00 Hz <= f _{act} <= 70.00 Hz 40.00 Hz <= f _{trip} <= 70.00 Hz				

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Protokollposition Protocol Item	Prüfung Test	Prüfbedingung Ableitbarbereich Voraussetzungen	Testwerte Test values	Zulässige Toleranz Grenzwerte (lt. Techn. Daten) (Acc. to Techn. Data)	Permissible Tolerance Limiting values (Acc. to Techn. Data)	Prüfergebnis Bemerkungen	Test result Remarks
1.18.2	Rückfallzeiten Dropout times	Wie Po-Case Item 1.18.2				bestätigt / confirmed	
1.18.3	Anregelzeiten Pickup times	Wie Po-Case Item 1.18.3				bestätigt / confirmed	
1.18.4	Rückfallzeiten Dropout times	Wie Po-Case Item 1.18.4				bestätigt / confirmed	
1.18.5	Verzögerungszeiten Time Delays	Zusätzlich zur Eigenzeit Added to the inherent opening time	0.00 s bis / to 60.00 s			bestätigt / confirmed	
1.18.8	Anregelzeiten Pickup times	Wie Po-Case Item 1.18.8				bestätigt / confirmed	
1.18.9	Rückfallzeiten (extern) Dropout times (external)	Zusätzlich zur Eigenzeit Added to the inherent opening time	0.00 s bis / to 60.00 s			bestätigt / confirmed	
1.19	Drehfeldumkehrung Phase-Reversal Reversal						

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Protokollposition Protocol Item	Prüfung Test	Prüfbedingung Ableitbarbereich Voraussetzungen	Testwerte Test values	Zulässige Toleranz Grenzwerte (lt. Techn. Daten) (Acc. to Techn. Data)	Permissible Tolerance Limiting values (Acc. to Techn. Data)	Prüfergebnis Bemerkungen	Test result Remarks
1.18.2	Rückfallzeiten Dropout times	Wie Po-Case Item 1.18.2				bestätigt / confirmed	
1.18.3	Anregelzeiten Pickup times	Wie Po-Case Item 1.18.3				bestätigt / confirmed	
1.18.4	Rückfallzeiten Dropout times	Wie Po-Case Item 1.18.4				bestätigt / confirmed	
1.18.5	Verzögerungszeiten Time Delays	Zusätzlich zur Eigenzeit Added to the inherent opening time	0.00 s bis / to 60.00 s			bestätigt / confirmed	
1.18.8	Anregelzeiten Pickup times	Wie Po-Case Item 1.18.8				bestätigt / confirmed	
1.18.9	Rückfallzeiten (extern) Dropout times (external)	Zusätzlich zur Eigenzeit Added to the inherent opening time	0.00 s bis / to 60.00 s			bestätigt / confirmed	
1.19	Drehfeldumkehrung Phase-Reversal Reversal						

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Prüfobjekt- position Product Item	Prüfung Test	Prüfbedingungen Test condition Operative range Specifications	Test values Test values	Zulässige Toleranz- Grenzwerte (lt. Techn. Daten) (Acc. to Techn. Data)	Prüfergebnis Remarks	Test result Remarks	
1.21.5	Verzögerungszeiten Time Delays	Zusätzlich zur Element- Anzahl In addition to the element count	0.00 s bis / to 60.00 s $t_{w} = 30$ Hz, 50 Hz	< 1% vom Einstellwert / of setting value low / or 10 ms - Fkt. lt. Handbuch / funct. acc. to manual	< 1% vom Einstellwert / of setting value low / or 10 ms - Funktion korrekt / Function correct	< 1% vom Einstellwert / of setting value low / or 10 ms - Funktion korrekt / Function correct	
1.21.6	Stromflussüberwachung Current flow monitoring	VEICER 0425 + IECER 8025S-1 Analogwert A, B	0.00 bis / to 100.000 A bei / at $t_{w} = 1A$ 0.15 bis / to 500.00 A bei / at $t_{w} = 5A$	< 1% vom Einstellwert / of setting value low / or 5 mA bei / at $t_{w} = 1A$ low / or 50 mA bei / at $t_{w} = 5A$	< 1% vom Einstellwert / of setting value low / or 5 mA bei / at $t_{w} = 1A$ low / or 50 mA bei / at $t_{w} = 5A$	< 1% vom Einstellwert / of setting value low / or 5 mA bei / at $t_{w} = 1A$ low / or 50 mA bei / at $t_{w} = 5A$	
1.21.7	Behälter mit LPS-Hilfskontakt Operation with CB auxiliary contact	10 % bis / to 45 %	10 % bis / to 45 %	< 1% vom Einstellwert / of setting value	< 1% vom Einstellwert / of setting value	< 1% vom Einstellwert / of setting value	
1.22	Einschaltstromerkennung Inrush-Current Detection	0.03 s bis / to 200.00 s	0.03 s bis / to 200.00 s	< 1% vom Einstellwert / of setting value low / or 5 ms	< 1% vom Einstellwert / of setting value low / or 5 ms	< 1% vom Einstellwert / of setting value low / or 5 ms	
1.22.1	Auslöschzeitpunkt Dropout delay	0.05 oder / or 0.015 A bei / at $t_{w} = 1A$ 0.05 oder / or 0.015 A bei / at $t_{w} = 5A$	0.05 oder / or 0.015 A bei / at $t_{w} = 1A$ 0.05 oder / or 0.015 A bei / at $t_{w} = 5A$	- Fkt. lt. Handbuch / funct. acc. to manual	- Funktion korrekt / Function correct	- Funktion korrekt / Function correct	
1.22.2	Strommessung Current measurement	0.05 oder / or 0.015 A bei / at $t_{w} = 1A$ 0.05 oder / or 0.015 A bei / at $t_{w} = 5A$	0.05 oder / or 0.015 A bei / at $t_{w} = 1A$ 0.05 oder / or 0.015 A bei / at $t_{w} = 5A$	- Fkt. lt. Handbuch / funct. acc. to manual	- Funktion korrekt / Function correct	- Funktion korrekt / Function correct	
1.22.4	Harmonische Typwert Harmonics Typewert	0.05 oder / or 0.015 A bei / at $t_{w} = 1A$ 0.05 oder / or 0.015 A bei / at $t_{w} = 5A$	0.05 oder / or 0.015 A bei / at $t_{w} = 1A$ 0.05 oder / or 0.015 A bei / at $t_{w} = 5A$	- Fkt. lt. Handbuch / funct. acc. to manual	- Funktion korrekt / Function correct	- Funktion korrekt / Function correct	

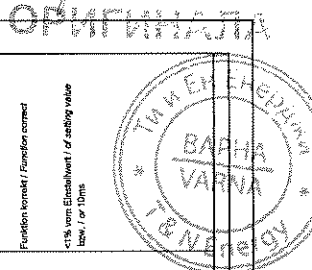
1) OOT (lt. Prot. lt. Item 0.2)

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Prüfobjekt- position Product Item	Prüfung Test	Prüfbedingungen Test condition Operative range Specifications	Test values Test values	Zulässige Toleranz- Grenzwerte (lt. Techn. Daten) (Acc. to Techn. Data)	Prüfergebnis Remarks	Test result Remarks	
1.20	Synchronisationsfunktion Synchronization function	max. Fehlzeit max. phase angle error	0.00 s bis / to 60.00 s	max. $\pm 1^\circ$ max. ± 10 mHz max. $\pm 1V$	max. Fehlzeit max. phase angle error	max. $\pm 0.2^\circ$ max. ± 10 mHz max. $\pm 0.15V$	
1.20.1	Synchronisation Switching at synchronism	Einrichtung mit LPS-Element Einrichtung CB operating time	0.00 s bis / to 60.00 s	lt. lt. Handbuch / funct. acc. to manual	Einrichtung mit LPS-Element Einrichtung CB operating time	lt. lt. Handbuch / funct. acc. to manual	
1.20.2	Asynchrones Schalten Asynchronous switching	Spannungslücken Schalten / De-energized switching	0.00 s bis / to 60.00 s	< 1% vom Einstellwert / of setting value low / or 10 ms	Spannungslücken Schalten / De-energized switching	< 1% vom Einstellwert / of setting value low / or 10 ms	
1.20.3	Zustufen Time stages	Kontrast-Programm Check programs	0.00 s bis / to 60.00 s	< 1% vom Einstellwert / of setting value low / or 10 ms	Kontrast-Programm Check programs	< 1% vom Einstellwert / of setting value low / or 10 ms	
1.20.4	bei Automatisch-Einschaltung - for auto-energise	bei Hand-Einschaltung - for manual close		- Fkt. lt. Handbuch / funct. acc. to manual	bei Automatisch-Einschaltung - for auto-energise	- Funktion korrekt / Function correct	
1.20.4.1				- Fkt. lt. Handbuch / funct. acc. to manual	bei Hand-Einschaltung - for manual close	- Funktion korrekt / Function correct	
1.20.4.2				- Fkt. lt. Handbuch / funct. acc. to manual		- Funktion korrekt / Function correct	

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Prüfobjekt- position Product Item	Prüfung Test	Prüfbedingungen Test condition Operative range Specifications	Test values Test values	Zulässige Toleranz- Grenzwerte (lt. Techn. Daten) (Acc. to Techn. Data)	Prüfergebnis Remarks	Test result Remarks	
1.22.5	Angriffen Pickup Times	ca. / approx. 25 ms + OOT ¹⁾		ca. / approx. 25 ms + OOT ¹⁾	bestätigt / confirmed	bestätigt / confirmed	
1.23	Thermobren für die Temperaturmessung Thermobren für die Temperatur- detection	Resistives / Connection RS 485, RTD20					
1.23.1	Temperaturdetektor Temperature Detectors	Anschließbare Thermobren 4 Connectable Thermobren 4	Max. 12		zusätzliche Anzahl angeschl. / numbers connect	zusätzliche Anzahl angeschl. / numbers connect	
1.23.2	Anz. Temp.-Sensoren 8 Thermobren No. of Temp. Snsrs. per Thermobren	Max. 12	Max. 12		zusätzliche Anzahl angeschl. / numbers connect	zusätzliche Anzahl angeschl. / numbers connect	
1.23.3	Messungsbereich Stufe 1 Thermobren für Induktion Stage 1	50°C bis / to 250°C 50°F bis / to 482°F	50°C bis / to 250°C 50°F bis / to 482°F	< 1% vom Einstellwert / of setting value low / or $\pm 1^\circ C$ oder / or $\pm 1^\circ F$	< 1% vom Einstellwert / of setting value low / or $\pm 1^\circ C$ oder / or $\pm 1^\circ F$	< 1% vom Einstellwert / of setting value low / or $\pm 1^\circ C$ oder / or $\pm 1^\circ F$	
1.23.4	Messungsbereich Stufe 2 Thermobren für Induktion Stage 2	50°C bis / to 250°C 50°F bis / to 482°F	50°C bis / to 250°C 50°F bis / to 482°F	< 1% vom Einstellwert / of setting value low / or $\pm 1^\circ C$ oder / or $\pm 1^\circ F$	< 1% vom Einstellwert / of setting value low / or $\pm 1^\circ C$ oder / or $\pm 1^\circ F$	< 1% vom Einstillwert / of setting value low / or 10 ms	
1.23.5	Rückstellzeit Dropout delay	3°C oder / or 3°F	3°C oder / or 3°F	Funktion korrekt / Function correct	Funktion korrekt / Function correct	Funktion korrekt / Function correct	
1.23.6	Verzögerungszeit Time Delay	Zusätzlich zur Element- Anzahl In addition to the element count	0.00 s bis / to 60.00 s	< 1% vom Einstellwert / of setting value low / or 10 ms	< 1% vom Einstillwert / of setting value low / or 10 ms	< 1% vom Einstillwert / of setting value low / or 10 ms	

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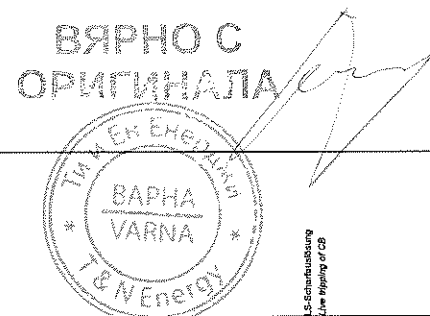
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Prüfobjekt- position Protocol Item	Prüfung Test	Prüfbedingung Abtestbereich Voraussetzungen	Test condition Operative range Specifications	Zulässige Toleranz Grenzwerte (ll. Techn. Daten)	Permissible Tolerance Limiting values (Acc. to Techn. Data)
1.25.1.6	Erdbilderrückmeldung Annotated Earth Fault Protection Currents	Keine, keine S, P, Q Strommessbereich Rated Current Range 1 A / 5 A Strommessbereich Rated Current Range 100 A, 1.5 A	In IMANAVAR (gen). IMANAVAR (gen). IMANAVAR (gen).	0.2 % vom Messwert in den gültigen Bereich S: ±0.5 % von I _{set} bei 1/30 bis zu 120 % U _N /V _N I _{set} P: ±0.5 % von I _{set} bei 1/30 bis zu 120 % U _N /V _N I _{set} und / and range ±0.7 Q: ±1 % von I _{set} bei 1/30 bis zu 120 % U _N /V _N I _{set} und / and range ±0.7	0.2 % vom Messwert in den gültigen Bereich S: ±0.5 % von I _{set} bei 1/30 bis zu 120 % U _N /V _N I _{set} P: ±0.5 % von I _{set} bei 1/30 bis zu 120 % U _N /V _N I _{set} und / and range ±0.7 Q: ±1 % von I _{set} bei 1/30 bis zu 120 % U _N /V _N I _{set} und / and range ±0.7
1.25.1.8	Lösungsfaktor Power factor	PF = 0.99		≤ 20 mHz	≤ 20 mHz
1.25.1.9	Frequenz Frequency	In Hz und / and % I _N		Im Bereich der range I _N ± 10 % und / and I _N 50Hz / or U _N / V _N I _N	Im Bereich der range I _N ± 10 % und / and I _N 50Hz / or U _N / V _N I _N
1.25.1.10	Energiewert Energy values	Abgetriggert: W _{set} , W _{th} Ablenkenzeitpunkt: W _{set} , W _{th}	0 kWh, 0 kWh, 0 kWh see / see MVAR, MVAR, GUARD	± 2 % bei I _N > 0.1 I _N , U _N > 0.1 U _N und / and range ± 0.20%	± 2 % bei I _N > 0.1 I _N , U _N > 0.1 U _N und / and range ± 0.20%

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Prüfobjekt- position Protocol Item	Prüfung Test	Prüfbedingung Abtestbereich Voraussetzungen	Test condition Operative range Specifications	Zulässige Toleranz Grenzwerte (ll. Techn. Daten)	Permissible Tolerance Limiting values (Acc. to Techn. Data)
1.24	Überwachungsfunktionen Supervision functions			- Fkt. lt. Handbuch / funct. acc. to manual	- Funktion korrekt / Function correct
1.24.1	Spannungswandler-Schutzschalter Voltage Transformer Circuit Breaker			- Fkt. lt. Handbuch / funct. acc. to manual	- Funktion korrekt / Function correct
1.24.2	Stromsymmetrieüberwachung Current-balance supervision			- Fkt. lt. Handbuch / funct. acc. to manual	- Funktion korrekt / Function correct
1.24.3	Spannungsmittelwertüberwachung Voltage-average supervision			- Fkt. lt. Handbuch / funct. acc. to manual	- Funktion korrekt / Function correct
1.24.4	Stromsummenüberwachung Current-sum supervision			- Fkt. lt. Handbuch / funct. acc. to manual	- Funktion korrekt / Function correct
1.24.5	Spannungsummenüberwachung Voltage-sum supervision			- Fkt. lt. Handbuch / funct. acc. to manual	- Funktion korrekt / Function correct
1.24.6	Messspannungsauswahl (Fis- Faktor-Matrix) Measuring Voltage Factor (Fis Factor matrix)			- Fkt. lt. Handbuch / funct. acc. to manual	- Funktion korrekt / Function correct
1.24.7	Stromfehler-Überwachung Current-relation field supervision			- Fkt. lt. Handbuch / funct. acc. to manual	- Funktion korrekt / Function correct
1.24.8	Spannungsfeld-Überwachung Voltage-relation field supervision			- Fkt. lt. Handbuch / funct. acc. to manual	- Funktion korrekt / Function correct
1.24.9	Auslastungsüberwachung 7470 Trip status supervision		Artikel-Nr. / Number of detail Abtestbereich / Operation mode	- Fkt. lt. Handbuch / funct. acc. to manual	- Funktion korrekt / Function correct

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Prüfobjekt- position Protocol Item	Prüfung Test	Prüfbedingung Abtestbereich Voraussetzungen	Test condition Operative range Specifications	Zulässige Toleranz Grenzwerte (ll. Techn. Daten)	Permissible Tolerance Limiting values (Acc. to Techn. Data)
1.25	Messwerte Measure values			f _{me} = 50 Hz, 60 Hz	
1.25.1	Betriebsmesswerte Operational measure values		Spannungswandler / Voltage transformer 47.5 Hz bis zu 52.5 Hz at I _N = 50 Hz 37.5 Hz bis zu 62.5 Hz at I _N = 60 Hz		
1.25.1.1	Strom Currents		U _{L1} , U _{L2} , U _{L3} , 30 / A, B, C, 30		-0.2 % vom Messwert in den gültigen Bereich of the measured value in the valid ranges
1.25.1.2	Phasenwinkel Strom Phase angles currents		Strombereich / Current range 0.1 A bis zu 25 A		± 2° bei / at I _N
1.25.1.3	Spannungen Voltages		U _{L1} , U _{L2} , U _{L3} , 30 / V, VA, VC, VCA		-0.2 % vom Messwert in den gültigen Bereich of the measured value in the valid ranges
1.25.1.4	Phasenwinkel Spannungen Phase angles voltages		U _{L1} , U _{L2} , U _{L3} / VA, VB, VC		± 2° bei / at I _N
1.25.1.5	Differentialstrom Differential Protection Currents		Spannungsbereich / Voltage range 10 % bis zu 200 % U _N / V _N U _{L1} , U _{L2} , U _{L3} / V, VA, VB, VC		-0.2 % vom Messwert in den gültigen Bereich of the measured value in the valid ranges

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Prüfobjekt position Product/Item	Prüfung Test	Prüfbedingungen Abgabebereich Vorrichtung	Test condition Operative range Spezifikationen	Prüfwerte Test values	Zulässige Toleranz Grenzwerte (lt. Techn. Daten) (Acc. to Techn. Data)	Permissive Tolerance Limiting values (Acc. to Techn. Data)	Prüfergebnis Test result
2.1.2	Spannungsfähigkeit Dielectric test	IECEN 60255-5 IECEN 60255-27 IECEN 6070-2-1 VDE 0435	KC 2.5 kV, 50 Hz, 1 min DC 3.5 kV, 30 s je Polleiter 30 s each pole DC 700 V, 30 s je Polleiter 30 s each pole KC 3.25 kV, 50 Hz, 1 min	alle Kreisläufe außer Hilfsanlagung Einzelanlagung und soziale Schaltstellen all circuits except auxiliary dc voltage input, bi-polar inputs and serial interfaces Hilfsanlagung und Einzelanlagung auxiliary voltage input and bi-polar inputs nur abgeprüfte serielle Schaltstellen only tested serial interfaces Komponenten mit doppelter Isolation components designed for double/intermed Isolation	keine Ober-Durchschlagsart; Gerät erfüllt nach der Prüfung seine bestimmungsgemäße Aufgabe according to design requirements after test	Test result Remarks	

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Prüfobjekt position Product/Item	Prüfung Test	Prüfbedingungen Abgabebereich Vorrichtung	Test condition Operative range Spezifikationen	Prüfwerte Test values	Zulässige Toleranz Grenzwerte (lt. Techn. Daten) (Acc. to Techn. Data)	Permissive Tolerance Limiting values (Acc. to Techn. Data)	Prüfergebnis Test result
2.1.3	Stoßspannungsfähigkeit Impulse voltage withstand test	IECEN 60255-5 IECEN 60255-27 VDE 0435	5 kV (Schaltstrom) 1.2 µs/50 µs, 0.5 J 5 positive und 5 negative Stöße in Abständen von 1 s 5 positive und 5 negative Stöße in Intervallen of 1 s 5 kV (Schaltstrom) 1.2 µs/50 µs, 0.5 J 5 positive und 5 negative Stöße in Abständen von 1 s 5 positive und 5 negative Stöße in Intervallen of 1 s 1 kV (Schaltstrom) 1.2 µs/50 µs, 0.5 J 5 positive und 5 negative Stöße in Abständen von 1 s 5 positive und 5 negative Stöße in Intervallen of 1 s	Längspannung Langzeitwert; alle Kreisläufe "all circuits" Querschaltung Transceiver; alle Kreisläufe "all bi-polar inputs" alle Kreisläufe "all serial interfaces" except serial interfaces Komponenten mit doppelter Isolation components designed for double/intermed Isolation nur Langspannung / Langzeitwert only nur abgeprüfte serielle Schaltstellen only tested serial interfaces/serials only	Gerät erfüllt nach der Prüfung seine bestimmungsgemäße Aufgabe according to design requirements after test	Test result Remarks	
2.1.4	Isolationswiderrandsmessung Measurement of insulation resistance	IECEN 60255-5 IECEN 60255-27 VDE 0435-37	DC 500 V > 100 MΩ DC 500 V > 10 MΩ	alle Kreisläufe/circuits alle Kreisläufe/circuits	Isolationswiderrandsmessung > 100 MΩ		
2.2	Belastbarkeit Load capacity	IECEN 60255-27 VDE 0435-37	DC 500 V > 100 MΩ	alle Kreisläufe/circuits	Belastbarkeit > 10 MVA		

1.007 (S. Proj. 2. Item 0.2)

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Prüfobjekt position Product/Item	Prüfung Test	Prüfbedingungen Abgabebereich Vorrichtung	Test condition Operative range Spezifikationen	Prüfwerte Test values	Zulässige Toleranz Grenzwerte (lt. Techn. Daten) (Acc. to Techn. Data)	Permissive Tolerance Limiting values (Acc. to Techn. Data)	Prüfergebnis Test result
1.27	Schnittstellen Interfaces						
1.27.1	USB Schnittstelle USB interface (front panel)						
1.27.2	Integrierte Ethernet Schnittstelle Integrated Ethernet interface (rear)						
1.27.3	System-Schnittstellen System interfaces						
1.27.3.1	IEC 6070-5-03						
1.27.3.2	DNP3.0						
1.27.3.3	IEC 61850						
1.27.4	Zeitsynchronisationschnittstelle Time Synchronization						
1.27.5	Witchschnittstellen Protection interfaces						
1.27.6	PMU						

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SIEMENS Infrastructure & Cities Sector Smart Grid Division Energy Automation		TYPPRÜFUNG - TYPE TEST Transformatorerschutz V02.00 Transformer Protection V02.00		Ausgabe Edition 01 Datum Date 2012-11-23 Bericht Report TS1112-03 Blatt Sheet 0.6 - 53			
Prüfobjekt position Product/Item	Prüfung Test	Prüfbedingungen Abgabebereich Vorrichtung	Test condition Operative range Spezifikationen	Prüfwerte Test values	Zulässige Toleranz Grenzwerte (lt. Techn. Daten) (Acc. to Techn. Data)	Permissive Tolerance Limiting values (Acc. to Techn. Data)	Prüfergebnis Test result
2	Beanspruchung Stress tests						
2.1	Isolation Insulation						
2.1.1	Luft- und Kriechstrecken Clearance and creepage distance						

1.007 (S. Proj. 2. Item 0.2)

SIEMENS Infrastructure & Cities Sector Smart Grid Division Energy Automation		TYPRÜFUNG - TYPE TEST Transformatorschutz V02.00 Transformer Protection V02.00		Zusammenfassung Summary		Ausgabe Edition 01 Datum Date 2012-11-23 Bericht Report TS1112-03 Blatt Sheet 0.6 - 06	
Prüfobjekt- position Product Item	Prüfung Test	Prüfbedingung Abzählbereich Vorschritten	Test condition Operative range Specifications	Prüfwerte Test values	Zulässige Toleranz Grenzwerte (lt. Techn. Daten) (Acc. to Techn. Data)	Prüfgebnis Bemerkungen	Test result Remarks
2.2.1	Stromschleife Current circuits		Kurzschluss über geschlossenen Kontakt/Short-circuit across closed contact 250 A für 10/30 ms 3 Schaltzyklen im Abstand 10 s 3 operations with an interval of 10 s	DC 300 V dauernd/continuous	Keine Schäden / No damage; Gerät erfüllt nach Prüfung seine bestimmungsgemäße Aufgabe The equipment was seen to operate according to design requirements after test		Keine Schäden / No damage; Gerät erfüllt nach Prüfung seine bestimmungsgemäße Aufgabe The equipment was seen to operate according to design requirements after test
2.2.1.1	Standard-Eingänge (Schutzventil) Standard inputs (protection-class current transformers)		IEC-Entwurf für empfindliche Erdschlussfassung (Messwandler) IEE-Input für High-sensitive earth fault detection (instrument transformers)	Temp = 40 °C alle Ein- und Ausgänge max. belastet full load operation Temp = 70 °C Ruhezustand / quiescent state	Keine Schäden / No damage; Gerät erfüllt nach Prüfung seine bestimmungsgemäße Aufgabe The equipment was seen to operate according to design requirements after test		Keine Schäden / No damage; Gerät erfüllt nach Prüfung seine bestimmungsgemäße Aufgabe The equipment was seen to operate according to design requirements after test
2.2.1.2	IEE-Entwurf für empfindliche Erdschlussfassung (Messwandler) IEE-Input für High-sensitive earth fault detection (instrument transformers)		Stromschleife/Short-circuit Stress darüber: 1 s, 8 h Shut-down, 1 Halbzyklus mit Stromimpulse, 1 half cycle with current impulse, 1 s, → siehe Prot. (Item 2.2.1)	ke = 1 A, I _{th} = 5 A	Keine Schäden / No damage; Gerät erfüllt nach Prüfung seine bestimmungsgemäße Aufgabe The equipment was seen to operate according to design requirements after test		Keine Schäden / No damage; Gerät erfüllt nach Prüfung seine bestimmungsgemäße Aufgabe The equipment was seen to operate according to design requirements after test
2.2.2	Spannungskreis Voltage circuits		300 V dauernd/continuous		Keine Schäden / No damage; Gerät erfüllt nach Prüfung seine bestimmungsgemäße Aufgabe The equipment was seen to operate according to design requirements after test		Keine Schäden / No damage; Gerät erfüllt nach Prüfung seine bestimmungsgemäße Aufgabe The equipment was seen to operate according to design requirements after test

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SIEMENS Infrastructure & Cities Sector Smart Grid Division Energy Automation		TYPRÜFUNG - TYPE TEST Transformatorschutz V02.00 Transformer Protection V02.00		Zusammenfassung Summary		Ausgabe Edition 01 Datum Date 2012-11-23 Bericht Report TS1112-03 Blatt Sheet 0.5 - 05	
Prüfobjekt- position Product Item	Prüfung Test	Prüfbedingung Abzählbereich Vorschritten	Test condition Operative range Specifications	Prüfwerte Test values	Zulässige Toleranz Grenzwerte (lt. Techn. Daten) (Acc. to Techn. Data)	Prüfgebnis Bemerkungen	Test result Remarks
2.2.1	Stromschleife Current circuits		IEC-Entwurf für empfindliche Erdschlussfassung (Messwandler) IEE-Input für High-sensitive earth fault detection (instrument transformers)	ke = 1 A, I _{th} = 5 A	Keine Schäden / No damage; Gerät erfüllt nach Prüfung seine bestimmungsgemäße Aufgabe The equipment was seen to operate according to design requirements after test		Keine Schäden / No damage; Gerät erfüllt nach Prüfung seine bestimmungsgemäße Aufgabe The equipment was seen to operate according to design requirements after test
2.2.1.1	Standard-Eingänge (Schutzventil) Standard inputs (protection-class current transformers)		IEC-Entwurf für empfindliche Erdschlussfassung (Messwandler) IEE-Input für High-sensitive earth fault detection (instrument transformers)	ke = 1 A, I _{th} = 5 A	Keine Schäden / No damage; Gerät erfüllt nach Prüfung seine bestimmungsgemäße Aufgabe The equipment was seen to operate according to design requirements after test		Keine Schäden / No damage; Gerät erfüllt nach Prüfung seine bestimmungsgemäße Aufgabe The equipment was seen to operate according to design requirements after test
2.2.1.2	IEE-Entwurf für empfindliche Erdschlussfassung (Messwandler) IEE-Input für High-sensitive earth fault detection (instrument transformers)		Stromschleife/Short-circuit Stress darüber: 1 s, 8 h Shut-down, 1 Halbzyklus mit Stromimpulse, 1 half cycle with current impulse, 1 s, → siehe Prot. (Item 2.2.1)	ke = 1 A, I _{th} = 5 A	Keine Schäden / No damage; Gerät erfüllt nach Prüfung seine bestimmungsgemäße Aufgabe The equipment was seen to operate according to design requirements after test		Keine Schäden / No damage; Gerät erfüllt nach Prüfung seine bestimmungsgemäße Aufgabe The equipment was seen to operate according to design requirements after test
2.2.2	Spannungskreis Voltage circuits		300 V dauernd/continuous		Keine Schäden / No damage; Gerät erfüllt nach Prüfung seine bestimmungsgemäße Aufgabe The equipment was seen to operate according to design requirements after test		Keine Schäden / No damage; Gerät erfüllt nach Prüfung seine bestimmungsgemäße Aufgabe The equipment was seen to operate according to design requirements after test

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SIEMENS Infrastructure & Cities Sector Smart Grid Division Energy Automation		TYPRÜFUNG - TYPE TEST Transformatorschutz V02.00 Transformer Protection V02.00		Zusammenfassung Summary		Ausgabe Edition 01 Datum Date 2012-11-23 Bericht Report TS1112-03 Blatt Sheet 0.6 - 09	
Prüfobjekt- position Product Item	Prüfung Test	Prüfbedingung Abzählbereich Vorschritten	Test condition Operative range Specifications	Prüfwerte Test values	Zulässige Toleranz Grenzwerte (lt. Techn. Daten) (Acc. to Techn. Data)	Prüfgebnis Bemerkungen	Test result Remarks
2.2.1	Ausgabekreis Order relays (Standardrelais, Typ S) Standard relays, Typ S High-Speed Relay mit Halbbrückenanordnung, Typ HS) (Standard Relay, Type S High-Speed Relay with Semiconductor Arrangement, Type HS)		IECEN 61810-2 (VDE 0437 T120) IEEE 388 C37.26	Schaltleistungsfähigkeit Einfluss: 1000 WVA Auslastung: 30 MVA Typ S und F/Type S and F Auslastung: 1000 WVA Typ HS/Type HS Schaltleistungsfähigkeit ACDC 250 V Typ S und F/Type S and F AC 200 V, DC 250 V Zuläss. Stromempfangsleistung 5 A dauernd/continuous Kurzzeit-Schaltleistung/Short-time capacity	Keine Schäden / No damage; Gerät erfüllt nach Prüfung seine bestimmungsgemäße Aufgabe The equipment was seen to operate according to design requirements after test		Keine Schäden / No damage; Gerät erfüllt nach Prüfung seine bestimmungsgemäße Aufgabe The equipment was seen to operate according to design requirements after test
2.2.2	IEE-Entwurf für empfindliche Erdschlussfassung (Messwandler) IEE-Input für High-sensitive earth fault detection (instrument transformers)		IEE-Entwurf für empfindliche Erdschlussfassung (Messwandler) IEE-Input für High-sensitive earth fault detection (instrument transformers)	ke = 1 A, I _{th} = 5 A	Keine Schäden / No damage; Gerät erfüllt nach Prüfung seine bestimmungsgemäße Aufgabe The equipment was seen to operate according to design requirements after test		Keine Schäden / No damage; Gerät erfüllt nach Prüfung seine bestimmungsgemäße Aufgabe The equipment was seen to operate according to design requirements after test
2.2.3	Spannungskreis Voltage circuits		300 V dauernd/continuous		Keine Schäden / No damage; Gerät erfüllt nach Prüfung seine bestimmungsgemäße Aufgabe The equipment was seen to operate according to design requirements after test		Keine Schäden / No damage; Gerät erfüllt nach Prüfung seine bestimmungsgemäße Aufgabe The equipment was seen to operate according to design requirements after test

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SIEMENS Infrastructure & Cities Sector Smart Grid Division Energy Automation		TYPRÜFUNG - TYPE TEST Transformatorschutz V02.00 Transformer Protection V02.00		Zusammenfassung Summary		Ausgabe Edition 01 Datum Date 2012-11-23 Bericht Report TS1112-03 Blatt Sheet 0.5 - 07	
Prüfobjekt- position Product Item	Prüfung Test	Prüfbedingung Abzählbereich Vorschritten	Test condition Operative range Specifications	Prüfwerte Test values	Zulässige Toleranz Grenzwerte (lt. Techn. Daten) (Acc. to Techn. Data)	Prüfgebnis Bemerkungen	Test result Remarks
2.2.1	Stromschleife Current circuits		IEC-Entwurf für empfindliche Erdschlussfassung (Messwandler) IEE-Input für High-sensitive earth fault detection (instrument transformers)	ke = 1 A, I _{th} = 5 A	Keine Schäden / No damage; Gerät erfüllt nach Prüfung seine bestimmungsgemäße Aufgabe The equipment was seen to operate according to design requirements after test		Keine Schäden / No damage; Gerät erfüllt nach Prüfung seine bestimmungsgemäße Aufgabe The equipment was seen to operate according to design requirements after test
2.2.1.1	Standard-Eingänge (Schutzventil) Standard inputs (protection-class current transformers)		IEC-Entwurf für empfindliche Erdschlussfassung (Messwandler) IEE-Input für High-sensitive earth fault detection (instrument transformers)	ke = 1 A, I _{th} = 5 A	Keine Schäden / No damage; Gerät erfüllt nach Prüfung seine bestimmungsgemäße Aufgabe The equipment was seen to operate according to design requirements after test		Keine Schäden / No damage; Gerät erfüllt nach Prüfung seine bestimmungsgemäße Aufgabe The equipment was seen to operate according to design requirements after test
2.2.1.2	IEE-Entwurf für empfindliche Erdschlussfassung (Messwandler) IEE-Input für High-sensitive earth fault detection (instrument transformers)		Stromschleife/Short-circuit Stress darüber: 1 s, 8 h Shut-down, 1 Halbzyklus mit Stromimpulse, 1 half cycle with current impulse, 1 s, → siehe Prot. (Item 2.2.1)	ke = 1 A, I _{th} = 5 A	Keine Schäden / No damage; Gerät erfüllt nach Prüfung seine bestimmungsgemäße Aufgabe The equipment was seen to operate according to design requirements after test		Keine Schäden / No damage; Gerät erfüllt nach Prüfung seine bestimmungsgemäße Aufgabe The equipment was seen to operate according to design requirements after test
2.2.2	Spannungskreis Voltage circuits		300 V dauernd/continuous		Keine Schäden / No damage; Gerät erfüllt nach Prüfung seine bestimmungsgemäße Aufgabe The equipment was seen to operate according to design requirements after test		Keine Schäden / No damage; Gerät erfüllt nach Prüfung seine bestimmungsgemäße Aufgabe The equipment was seen to operate according to design requirements after test

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Prüfobjekt position / Process item	Prüfung Test	Prüfbereich Arbeitbereich / Workstation	Test condition Operative range / Specifications	Zulässige Toleranz Grenzwerte (B. Techn. Daten) / (Acc. to Techn. Data)	Permissible Tolerance Limiting values	Prüfprotokoll Bemerkungen / Remarks	Test result Remarks
2.5.6	Fluide Wärmezyklisch (12 h + 12 h) / Fluids (12+12 hour cycle)	IECEN 60068-2-50, Prüfung Test B0	Umfeld Temperatur / Ambient temperature: 25 °C ± 2 °C Rel. Feuchte / relative humidity: 93 % ± 2 % Obere Temperatur / Upper test temperature: 55 °C ± 2 °C Rel. Feuchte / relative humidity: 95 % ± 2 % Chlor-Temperaturwechsel / Chlor temperature change: 10 K (12 Körn) / 10 K (12 Körn) Brummschwingen / Vibration: 1 = 6 Tage (6 Zyklen mit je 24 h) / 1 = 6 of 6 cycles each 24 h			Geprüft durch/checked by: ALUCOTEAM GmbH, 10407 Berlin / Report no.: PA7827/0.01	Keine Schäden/No damage: Gerät erfüllt nach der Prüfung seine bestimmungsgemäße Aufgabe / The equipment was seen to operate according to design requirements after test
2.6	Temperatur- und Altlastbeanspruchung während Lagerung und Transport / Temperature and transport during storage and transport	IECEN 60068-2-27, Prüfung Test A0				Keine Schäden/No damage: Gerät erfüllt nach der Prüfung seine bestimmungsgemäße Aufgabe / The equipment was seen to operate according to design requirements after test	
2.6.1	Kälte / Cold	IECEN 60068-2-1, Prüfung Test A0	β = -40 °C t = 88 h				

1.00T (E-Proc-Subform 02)

SIEMENS Infrastructure & Cities Sector Smart Grid Division Energy Automation		TYPPRÜFUNG - TYPE TEST Transformatorschutz V02.00 Transformer Protection V02.00		Zusammenfassung Summary		Ausgabe Edition: 01 Datum Date: 2012-11-23 Bericht Report: TS1112-03 Blatt Sheet: 0.6 - 80	
Prüfobjekt position / Process item	Prüfung Test	Prüfbereich Arbeitbereich / Workstation	Test condition Operative range / Specifications	Zulässige Toleranz Grenzwerte (B. Techn. Daten) / (Acc. to Techn. Data)	Permissible Tolerance Limiting values	Prüfprotokoll Bemerkungen / Remarks	Test result Remarks
			Während der Hochlaufphase des Gerätes ist ein sog. Crypto Processor auf der CP200 aktiv (Signalverarbeitung). Dieser crypto Processor arbeitet gemäß den technischen Daten im Temperaturbereich 25 °C bis 85 °C. Ein Einhalten des Gerätes bei -40 °C ist deshalb nicht möglich da der crypto Processor den Hochlauf aus Sicherheitsgründen blockiert. Ein abnormales Abweichen der Umgebungtemperatur im tiefsten Betriebs auf -40 °C ist prüfen möglich. Ein abnormales Abweichen des Betriebes bei 85 °C ist ohne Zeitverschiebung zu prüfen. Ein abnormales Abweichen des Betriebes bei 85 °C ist. / During the start up phase of the device a crypto processor on the CP200 board is active (signal processing). This crypto processor only works according to the data sheet in the temperature range from -25 °C to 85 °C. Due to this fact it is not possible to operate the device at -40 °C in the course of security. But decreasing of the ambient temperature during the operation will to -40 °C is possible. Also switch off and switch on of a device which is operating for several hours at 85 °C ambient temperature is not successful since the temperature on the crypto processor chip is over 85 °C.				

1.00T (E-Proc-Subform 02)

SIEMENS Infrastructure & Cities Sector Smart Grid Division Energy Automation		TYPPRÜFUNG - TYPE TEST Transformatorschutz V02.00 Transformer Protection V02.00		Zusammenfassung Summary		Ausgabe Edition: 01 Datum Date: 2012-11-23 Bericht Report: TS1112-03 Blatt Sheet: 0.6 - 63	
Prüfobjekt position / Process item	Prüfung Test	Prüfbereich Arbeitbereich / Workstation	Test condition Operative range / Specifications	Zulässige Toleranz Grenzwerte (B. Techn. Daten) / (Acc. to Techn. Data)	Permissible Tolerance Limiting values	Prüfprotokoll Bemerkungen / Remarks	Test result Remarks
2.6.2	Trockene Wärme / Dry heat	IECEN 60068-2-2, Prüfung Test B0	β = +70 °C t = 88 h			Keine Schäden/No damage: Gerät erfüllt nach der Prüfung seine bestimmungsgemäße Aufgabe / The equipment was seen to operate according to design requirements after test	
2.6.3	Rechner Temperaturwechsel / Fast temperature change	IECEN 60068-2-14, Prüfung Test A0	Temperatur / Temperature: 25 °C Anzahl / Number: 10 Dauer / Duration: 2 h Anzahl / Number: 10 Dauer / Duration: 10 s 10 Zyklen / 10 cycles			Geprüft durch/checked by: ALUCOTEAM GmbH, 10407 Berlin / Report no.: PA7827/0.01	Keine Schäden/No damage: Gerät erfüllt nach der Prüfung seine bestimmungsgemäße Aufgabe / The equipment was seen to operate according to design requirements after test
2.7	Industrieatmosphäre / Industrial atmosphere	Geprüft in Betrieb / Tested in operation	Korrosion / Korrosion: 10 ppm SO ₂ , 1 = 4 d DIN 40046 V T36 (Test A) DIN 40046 V T37 (Test A) 1 ppm H ₂ S, 1 = 4 d IEC 60068-2-60, Mehrschichtmethode / IEC 60068-2-60, Multilayer method SO ₂ : 0.2 ppm H ₂ S: 0.01 ppm Cl ₂ : 0.01 ppm t = 10 d			Keine Schäden/No damage: Gerät erfüllt nach der Prüfung seine bestimmungsgemäße Aufgabe / The equipment was seen to operate according to design requirements after test	
2.7.1	Getestete, salzsaure / Tested, acidic	IECEN 60068-2-42, Prüfung Test A0					
-S02		IECEN 60068-2-45, Prüfung Test A0					
-H2S		Mehrschichtmethode / Multilayer method					
2.7.2							

1.00T (E-Proc-Subform 02)

SIEMENS Infrastructure & Cities Sector Smart Grid Division Energy Automation		TYPPRÜFUNG - TYPE TEST Transformatorschutz V02.00 Transformer Protection V02.00		Zusammenfassung Summary		Ausgabe Edition: 01 Datum Date: 2012-11-23 Bericht Report: TS1112-03 Blatt Sheet: 0.6 - 81	
Prüfobjekt position / Process item	Prüfung Test	Prüfbereich Arbeitbereich / Workstation	Test condition Operative range / Specifications	Zulässige Toleranz Grenzwerte (B. Techn. Daten) / (Acc. to Techn. Data)	Permissible Tolerance Limiting values	Prüfprotokoll Bemerkungen / Remarks	Test result Remarks
2.5.1	Kälte / Cold	IECEN 60068-2-1, Prüfung Test A0	Gerät abschalten bei β = -25 °C und Temperatur halbiert / Switch off at β = -25 °C and half temperature for 1 h Gerät abschalten bei β = -40 °C / Switch off at β = -40 °C for 1 h Temperatur im Betrieb reduzieren auf β = -40 °C für t = 18 h / Reduce temperature during operation to β = -40 °C for t = 18 h			Keine Schäden/No damage: Gerät erfüllt nach der Prüfung seine bestimmungsgemäße Aufgabe / The equipment was seen to operate according to design requirements after test	
2.5.2	Kälte / Cold	IECEN 60068-2-1, Prüfung Test A0	β = -70 °C t = 88 h β = -48 °C t = 18 h			Keine Schäden/No damage: Gerät erfüllt nach der Prüfung seine bestimmungsgemäße Aufgabe / The equipment was seen to operate according to design requirements after test	
2.5.3	Trockene Wärme / Dry heat	IECEN 60068-2-2, Prüfung Test B0	30 min ± 25 °C 3 max ± 75 °C 1 min ± 10 h to 14 h 1 = 5 Zyklen / 1 = 5 cycles			Keine Schäden/No damage: Gerät erfüllt nach der Prüfung seine bestimmungsgemäße Aufgabe / The equipment was seen to operate according to design requirements after test	
2.5.4	Langsame Temperaturwechsel / Slow temperature change	IECEN 60068-2-14, Prüfung Test A0				Keine Schäden/No damage: Gerät erfüllt nach der Prüfung seine bestimmungsgemäße Aufgabe / The equipment was seen to operate according to design requirements after test	
2.5.5	Feuchte Wärme: konstant / Humid heat: steady state	IECEN 60068-2-3, Prüfung Test C0				Keine Schäden/No damage: Gerät erfüllt nach der Prüfung seine bestimmungsgemäße Aufgabe / The equipment was seen to operate according to design requirements after test	

1.00T (E-Proc-Subform 02)

SIEMENS Infrastructure & Cities Sector Smart Grid Division Energy Automation		TYPPRÜFUNG - TYPE TEST Transformatorerschutz V02.00 Transformer Protection V02.00		Zusammenfassung Summary		Ausgabe Edition 01 Datum Date 2012-11-23 Bericht Report TS1112-03 Blatt Sheet 0.6 - 06	
Prüfobjekt position Protocol item	Prüfung Test	Prüfbedingung Test condition	Prüfwerte Test values	Zulässige Toleranz Permissible tolerance	Prüfergebnis Test result	Zusammenfassung Summary	Prüfergebnis Test result
2.8.3	Schwingen, stationäre, statischer Einsatz; Vibration, stationary use	IECEN 60086-2:27 IECEN 60086-3:3 Prüfung/Test Pc IECEN 60255-21-3 Klasse/Class 2	Frequenzbereich/frequency range: - 1 Hz bis 150 Hz Beanspruchung/Stress: - sinusförmig/sinusoidal - 1 Hz bis 8 Hz ± 8 mm Amplitude vertikale Achse/ amplitude vertical axis ± 4 mm Amplitude vertikale Achse/ amplitude vertical axis 9 Hz bis 85 Hz 20 ms ² Beschleunigung horizontale Achse/ acceleration horizontal axis - 10 ms ² Beschleunigung vertikale Achse/ acceleration vertical axis - 1 Okta/M octave - 1 240/cycle In den drei Geradenachsen in the three main axes of device	(s. Techn. Daten) / (see. to Techn. Data)	Das Gerät erfüllt während und nach der Beanspruchung seine bestimmungsgemäße Aufgabe. The equipment was seen to operate according to design requirements during and after stress.	Zusätzliche Toleranz Grenzweite (s. Techn. Daten) / (see. to Techn. Data)	Prüfergebnis Bemerkungen
2.8.4	Schicken, stationärer Einsatz; Shock, stationary use	IECEN 60086-2:27 Prüfung/Test Ea IECEN 60255-21-2 Klasse/Class 1	Je 3 Schocks/3 shocks at a time pro Achse und Richtung per main axis and direction 50 ms ² , 11 ms Halbsinus/ half sinusoidal	(s. Techn. Daten) / (see. to Techn. Data)	Das Gerät erfüllt während und nach der Beanspruchung seine bestimmungsgemäße Aufgabe. The equipment was seen to operate according to design requirements during and after stress.	Zusätzliche Toleranz Grenzweite (s. Techn. Daten) / (see. to Techn. Data)	Prüfergebnis Bemerkungen

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Prüfobjekt position Protocol item	Prüfung Test	Prüfbedingung Test condition	Prüfwerte Test values	Zulässige Toleranz Permissible tolerance	Prüfergebnis Test result	Zusammenfassung Summary	Prüfergebnis Test result
2.8	Mechanisch dynamische Beanspruchung Mechanical dynamic stress	IECEN 60086-2:6 Prüfung/Test Pc IECEN 60255-21-1 Klasse/Class 2	Die Prüfungen wurden in Einbauposition und Aufbauposition 1/5 von 19 Zoll bis 11 von 19 Zoll durchgeführt. Tests were carried out on devices in housings for panel/flush mounting and on devices mounting 1/5 up to 11 of 19 inch	(s. Techn. Daten) / (see. to Techn. Data)	Das Gerät erfüllt während und nach der Beanspruchung seine bestimmungsgemäße Aufgabe. The equipment was seen to operate according to design requirements during and after stress.	Zusätzliche Toleranz Grenzweite (s. Techn. Daten) / (see. to Techn. Data)	Prüfergebnis Bemerkungen
2.8.1	Schwingen, stationäre, statischer Einsatz; Vibration, stationary use	IECEN 60086-2:6 Prüfung/Test Pc IECEN 60255-21-1 Klasse/Class 2	Frequenzbereich/frequency range: - 10 Hz bis 150 Hz Beanspruchung/Stress: - 10 Hz bis 85 Hz; ± 0.075 mm Amplitude/Amplitude ± 56 Hz bis 150 Hz 10 ms ² Beschleunigung/acceleration - 1 Okta/M octave - 1 240/cycle Prüfung/Test time: - 20 Zyklen/Cycles In den drei Geradenachsen in the three main axes of device	(s. Techn. Daten) / (see. to Techn. Data)	Das Gerät erfüllt während und nach der Beanspruchung seine bestimmungsgemäße Aufgabe. The equipment was seen to operate according to design requirements during and after stress.	Zusätzliche Toleranz Grenzweite (s. Techn. Daten) / (see. to Techn. Data)	Prüfergebnis Bemerkungen

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Prüfobjekt position Protocol item	Prüfung Test	Prüfbedingung Test condition	Prüfwerte Test values	Zulässige Toleranz Permissible tolerance	Prüfergebnis Test result	Zusammenfassung Summary	Prüfergebnis Test result
2.8.5	Schicken, Transport Shock, transport stress	IECEN 60086-2:27 Prüfung/Test Ea IECEN 60255-21-2 Klasse/Class 1	Je 3 Schocks/3 shocks at a time pro Achse und Richtung per main axis and direction 150 ms ² , 11 ms Halbsinus/ half sinusoidal	(s. Techn. Daten) / (see. to Techn. Data)	Das Gerät erfüllt nach der Beanspruchung seine bestimmungsgemäße Aufgabe. The equipment was seen to operate according to design requirements after stress.	Zusätzliche Toleranz Grenzweite (s. Techn. Daten) / (see. to Techn. Data)	Prüfergebnis Bemerkungen
2.8.6	Dauerstöße, Transport Bump and (continuous shock); transport stress	IECEN 60086-2:29 Prüfung/Test Eb IECEN 60255-21-2 Klasse/Class 1	Je 1000 Schocks/1000 shocks at a time pro Achse und Richtung per main axis and direction 100 ms ² , 16 ms Halbsinus/ half sinusoidal	(s. Techn. Daten) / (see. to Techn. Data)	Das Gerät erfüllt nach der Beanspruchung seine bestimmungsgemäße Aufgabe. The equipment was seen to operate according to design requirements after stress.	Zusätzliche Toleranz Grenzweite (s. Techn. Daten) / (see. to Techn. Data)	Prüfergebnis Bemerkungen

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Prüfobjekt position Protocol item	Prüfung Test	Prüfbedingung Test condition	Prüfwerte Test values	Zulässige Toleranz Permissible tolerance	Prüfergebnis Test result	Zusammenfassung Summary	Prüfergebnis Test result
2.8.2	Schwingen, stationäre, statischer Einsatz; Vibration, stationary use	IECEN 60086-2:6 Prüfung/Test Pc IECEN 60255-21-1 Klasse/Class 2	Frequenzbereich/frequency range: 5 Hz bis 150 Hz Beanspruchung/Stress: - 5 Hz bis 8 Hz; ± 0.075 mm Amplitude/Amplitude ± 56 Hz bis 150 Hz; 20 ms ² Beschleunigung/acceleration - 1 Okta/M octave Prüfung/Test time: - 20 Zyklen/Cycles In den drei Geradenachsen in the three main axes of device	(s. Techn. Daten) / (see. to Techn. Data)	Das Gerät erfüllt nach der Beanspruchung seine bestimmungsgemäße Aufgabe. The equipment was seen to operate according to design requirements after stress.	Zusätzliche Toleranz Grenzweite (s. Techn. Daten) / (see. to Techn. Data)	Prüfergebnis Bemerkungen

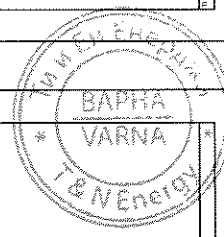
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Prüfobjekt- position Product Item	Prüfung Test	Prüfobjekt- Anzeigebereich Vorsicht - IEC 60255-1 - VDE 0435	Test condition Operative range Specifications	Zulässige Toleranz Grenzwerte (lt. Techn. Daten) (Acc. to Techn. Data)	Permissive Tolerance Limiting values (Acc. to Techn. Data)	Prüfergebnis Bemerkungen	Test result Remarks
3.1.5	Hoch- und Herunterfahren der Hilfsspannung Up and down ramping of auxiliary supply voltage	DC: U ₁ /U ₂ = 24 V DC: U ₁ /U ₂ = 60 V extrem hohe Lastfälle at extremely loading cases A), B), C), D) 0 V → 100 % U ₁ /U ₂ innerhalb 80 s 100 % U ₁ /U ₂ → 0 V innerhalb 80 s					
3.1.6	Verpölung der Hilfsspannung Wrong polarity for auxiliary supply voltage	Verpölung der Hilfsspannung mit Wiring polarity for auxiliary supply voltage may not lead to the internal service fuse blowing.					
3.2	Temperatur Temperature	U ₁ /U ₂ = DC: 80 V, 110 V, 120 V, 220 V, 250 V und/oder und/or AC: 100 V, 115 V, 230 V - IEC 60255-1 - VDE 0435 Für alle Funktionen For all functions	-10 °C ≤ Tamb ≤ +55 °C	± 0,5 %/10 K		Keine Fehlfunktion / No misoperation	Das Gerät läuft nicht an / no running system Das Gerät schaltet nach der Unterbrechung des Stroms wieder ein / the device re-energizes after interruption of the power supply The equipment was seen to operate according to design requirements after stress normaler Betrieb / normal running system Keine Fehlfunktion / No misoperation

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Prüfobjekt- position Product Item	Prüfung Test	Prüfobjekt- Anzeigebereich Vorsicht - IEC 60255-1 - VDE 0435	Test condition Operative range Specifications	Zulässige Toleranz Grenzwerte (lt. Techn. Daten) (Acc. to Techn. Data)	Permissive Tolerance Limiting values (Acc. to Techn. Data)	Prüfergebnis Bemerkungen	Test result Remarks
3	Einfussgrößen Influencing quantities	extreme Lastfälle A) Ruhelastfall B) max. Wechselschaltung (s. Kap. 1.1.3) C) Messgrößen ± 5 % inner than unter Anspannung D) Messgrößen ± 5 % über Anspannung and max. Wechselschaltung					
3.1	Hilfsspannung LH Auxiliary de voltage LH	Prüfung an Auslieferung 1/1 15" Tests were carried out on a device 1/1 of 19 inch			extremely loading cases: A) initial condition B) max. operated condition (see item 1.1.3) C) measuring quantities ± 5 % inner than measuring quantities ± 5 % higher than measured pickup values and max. operated condition U ₁ /VAC: 0.80 ≤ U ₁ /U ₂ ≤ 1.20 U ₁ /VAC: 0.80 ≤ U ₁ /U ₂ ≤ 1.15		Kein Einfluss auf die Genauigkeit/Funktion: No influence on the accuracy and function
3.1.1	Betriebsprozess Limits of operation	(für alle externen Lastfälle at all external loading cases A), B)					
3.1.2	Welligkeit Ripple	(für alle externen Lastfälle at all external loading cases A), C), D)			≤ 15 % der Nennspannung, abhängig von den Betriebsstromen ± 20 % ≤ 15 % of rated voltage, related at the limits of I _N ± 20 % U ₁ /VAC: 0.80 ≤ U ₁ /U ₂ ≤ 1.20 U _N with superimposed ripple (Spannungs- oder Stromwert) 0 % bis zu 15 % von U _N I _N = 16.7 Hz, 50 Hz, 100 Hz, 300 Hz (f _{ref} = 50 Hz)		Keine Fehlfunktion/No misoperation
3.1.3	Zu- und Abschalten Switching on/off	(- IEC 60255-1 - VDE 0435					

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Prüfobjekt- position Product Item	Prüfung Test	Prüfobjekt- Anzeigebereich Vorsicht - IEC 60255-1 - VDE 0435	Test condition Operative range Specifications	Zulässige Toleranz Grenzwerte (lt. Techn. Daten) (Acc. to Techn. Data)	Permissive Tolerance Limiting values (Acc. to Techn. Data)	Prüfergebnis Bemerkungen	Test result Remarks
3.3	Frequenz Frequency		0.85 ≤ f _{ref} ≤ +1.05			Abweichung/Deviation 5 from measured value at reference condition	Keine Fehlfunktion / No misoperation
3.4	Harmonische Harmonics		10 % 3. Harmonische/Harmonics oder or 10 % 5. Harmonische/Harmonics			Abweichung/Deviation 5 from measured value at reference condition	Keine Zusatzabweichung feststellbar. No additional deviation detected Einfluss vernachlässigbar/Influence negligible
4	Elektromagnetische Verträglichkeit (EMV) Electromagnetic compatibility (EMC)						
4.1	Störfestigkeit Immunity						

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Prüfobjekt- position Product Item	Prüfung Test	Prüfobjekt- Anzeigebereich Vorsicht - IEC 60255-1 - VDE 0435	Test condition Operative range Specifications	Zulässige Toleranz Grenzwerte (lt. Techn. Daten) (Acc. to Techn. Data)	Permissive Tolerance Limiting values (Acc. to Techn. Data)	Prüfergebnis Bemerkungen	Test result Remarks
3.1.4	Unterbrechung und Kurzschluss Interruption and short circuit (Interruption with high and low impedance of source voltage)	(für alle externen Lastfälle at all external loading cases A), C), D)				Überbrechung/Short-circuiting time for all loading cases and supply voltages	Keine Fehlfunktion/No misoperation
		U ₁ /U ₂ = DC: 24V, 45V U ₁ /U ₂ = DC: 80 V, 110 V, 120 V, 220 V, 250 V und/oder und/or AC: 100 V, 115 V, 230 V					60 % alle Ausgabemodule angeschlossen, 2 Kommunikationmodule aktiv 60 % of output modules energized, 2 communication modules activated t ₁ ≤ 200 ms t ₂ ≤ 200 ms t ₃ ≤ 50 ms t ₄ ≤ 150 ms t ₅ ≤ 180 ms t ₆ ≤ 500 ms t ₇ ≤ 650 ms



Prüfungsposition Pretest item	Prüfung Test	Prüfbedingungen Abzählbereich Vorschaltbar	Test condition Operative range Specifications	Prüfwerte Test values	Zulässige Toleranz Grenzwerte (lt. Techn. Daten) Permissible tolerance Limiting values (Acc. to Techn. Data)	Prüfergebnis Bemerkungen Remarks	Test result Anmerkungen Remarks
4.1.1	HF-Feld, amplitudenmoduliert Ersatzstrom Ersatzfeld, amplitude modulated Spot frequency test	- IECEN 60255-22-3 (VDE 0435 T02-1) Klassen/Class A	80 MHz, 150 MHz, 300 MHz, 20 Vm (Ersatzwert, unmoduliert) (rms, unmodulated) 80 % AN; 1 kHz; t = 10 s	Amplitudenhöhe: - Unterfrequenzbereich 2,5 kV (Schaltspannung) - Querschnittsstrom 2,5 kV (Schaltspannung) Wiederholungsrate, Frequenz 400 Hz Pulsbreite: 10 s	Kriterium / criterion B	Geprüft durch / tested by - PRO EMV GmbH, 15344 Strausberg Keine Fehlfunktion / no malfunction Geht erfüllt seine bestimmungsgemäße Aufgabe. The equipment was seen to operate according to design requirements.	Keine Fehlfunktion / no malfunction Geht erfüllt seine bestimmungsgemäße Aufgabe. The equipment was seen to operate according to design requirements.
4.1.2	HF-Feld, pulsbreitenmoduliert Ersatzstrom Ersatzfeld, pulse modulated Spot frequency test	- IECEN 60255-22-3 (VDE 0435 T02-2) Klassen/Class A	80 MHz, 150 MHz, 300 MHz, 20 Vm (Ersatzwert, unmoduliert) (rms, unmodulated) 80 % AN; 1 kHz; t = 10 s	Kontaktschaltzeit / contact discharge 3 kV, 4 kV, 6 kV, 8 kV Lüftungsleistung / discharge 2 kV, 4 kV, 6 kV, 8 kV, 16 kV beide Polarisierbar / polarity C = 150 pF, RI = 300 Ω	Kriterium / criterion B	Geprüft durch / tested by - PRO EMV GmbH, 15344 Strausberg Keine Fehlfunktion / no malfunction Geht erfüllt seine bestimmungsgemäße Aufgabe. The equipment was seen to operate according to design requirements.	Keine Fehlfunktion / no malfunction Geht erfüllt seine bestimmungsgemäße Aufgabe. The equipment was seen to operate according to design requirements.
4.1.3	HF-Feld, pulsbreitenmoduliert Ersatzstrom Ersatzfeld, pulse modulated Spot frequency test	- IECEN 60255-22-3 (VDE 0435 T02-3) Klassen/Class IV	80 MHz, 150 MHz, 300 MHz, 20 Vm (Ersatzwert, unmoduliert) (rms, unmodulated) 80 % AN; 1 kHz; t = 10 s	Störfestigkeit gegen hochfrequente elektromagnetische Felder Resonanz elektromagnetischer Felder disturbance test	Kriterium / criterion A	Geprüft durch / tested by - PRO EMV GmbH, 15344 Strausberg Keine Fehlfunktion / no malfunction Geht erfüllt seine bestimmungsgemäße Aufgabe. The equipment was seen to operate according to design requirements.	Keine Fehlfunktion / no malfunction Geht erfüllt seine bestimmungsgemäße Aufgabe. The equipment was seen to operate according to design requirements.

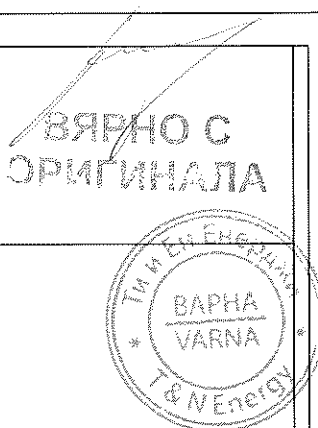
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Prüfungsposition Pretest item	Prüfung Test	Prüfbedingungen Abzählbereich Vorschaltbar	Test condition Operative range Specifications	Prüfwerte Test values	Zulässige Toleranz Grenzwerte (lt. Techn. Daten) Permissible tolerance Limiting values (Acc. to Techn. Data)	Prüfergebnis Bemerkungen Remarks	Test result Anmerkungen Remarks
4.1.3.4	HF-Feld, pulsbreitenmoduliert Ersatzstrom Ersatzfeld, pulse modulated Spot frequency test	- IECEN 60255-22-4 (VDE 0435 T02-4) Klassen/Class A	80 MHz, 150 MHz, 300 MHz, 20 Vm (Ersatzwert, unmoduliert) (rms, unmodulated) 80 % AN; 1 kHz; t = 10 s	Amplitude, Wiederholungsrate - Hilfspulsfrequenz - Hilfspulsenergie - Hilfspulsleistung - Alle anderen Ein- und Ausgänge an other inputs and outputs 4 kV, 5 kV 4 kV, 5 kV	Kriterium / criterion B	Geprüft durch / tested by - PRO EMV GmbH, 15344 Strausberg Keine Fehlfunktion / no malfunction Geht erfüllt seine bestimmungsgemäße Aufgabe. The equipment was seen to operate according to design requirements.	Keine Fehlfunktion / no malfunction Geht erfüllt seine bestimmungsgemäße Aufgabe. The equipment was seen to operate according to design requirements.
4.1.3.5	HF-Feld, pulsbreitenmoduliert Ersatzstrom Ersatzfeld, pulse modulated Spot frequency test	- IECEN 60255-22-4 (VDE 0435 T02-4) Klassen/Class A	80 MHz, 150 MHz, 300 MHz, 20 Vm (Ersatzwert, unmoduliert) (rms, unmodulated) 80 % AN; 1 kHz; t = 10 s	Amplitude, Wiederholungsrate - Hilfspulsfrequenz - Hilfspulsenergie - Hilfspulsleistung - Alle anderen Ein- und Ausgänge an other inputs and outputs 4 kV, 5 kV 4 kV, 5 kV	Kriterium / criterion A	Geprüft durch / tested by - PRO EMV GmbH, 15344 Strausberg Keine Fehlfunktion / no malfunction Geht erfüllt seine bestimmungsgemäße Aufgabe. The equipment was seen to operate according to design requirements.	Keine Fehlfunktion / no malfunction Geht erfüllt seine bestimmungsgemäße Aufgabe. The equipment was seen to operate according to design requirements.
4.1.3.6	HF-Feld, pulsbreitenmoduliert Ersatzstrom Ersatzfeld, pulse modulated Spot frequency test	- IECEN 60255-22-4 (VDE 0435 T02-4) Klassen/Class A	80 MHz, 150 MHz, 300 MHz, 20 Vm (Ersatzwert, unmoduliert) (rms, unmodulated) 80 % AN; 1 kHz; t = 10 s	Amplitude, Wiederholungsrate - Hilfspulsfrequenz - Hilfspulsenergie - Hilfspulsleistung - Alle anderen Ein- und Ausgänge an other inputs and outputs 4 kV, 5 kV 4 kV, 5 kV	Kriterium / criterion A	Geprüft durch / tested by - PRO EMV GmbH, 15344 Strausberg Keine Fehlfunktion / no malfunction Geht erfüllt seine bestimmungsgemäße Aufgabe. The equipment was seen to operate according to design requirements.	Keine Fehlfunktion / no malfunction Geht erfüllt seine bestimmungsgemäße Aufgabe. The equipment was seen to operate according to design requirements.

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Prüfungsposition Pretest item	Prüfung Test	Prüfbedingungen Abzählbereich Vorschaltbar	Test condition Operative range Specifications	Prüfwerte Test values	Zulässige Toleranz Grenzwerte (lt. Techn. Daten) Permissible tolerance Limiting values (Acc. to Techn. Data)	Prüfergebnis Bemerkungen Remarks	Test result Anmerkungen Remarks
4.1.3.1	HF-Feld, pulsbreitenmoduliert Ersatzstrom Ersatzfeld, pulse modulated Spot frequency test	- IECEN 60255-22-3 (VDE 0435 T02-3) Klassen/Class II	80 MHz, 150 MHz, 300 MHz, 20 Vm (Ersatzwert, unmoduliert) (rms, unmodulated) 80 % AN; 1 kHz; t = 10 s	Amplitude, Wiederholungsrate - Hilfspulsfrequenz - Hilfspulsenergie - Hilfspulsleistung - Alle anderen Ein- und Ausgänge an other inputs and outputs 4 kV, 5 kV 4 kV, 5 kV	Kriterium / criterion A	Geprüft durch / tested by - PRO EMV GmbH, 15344 Strausberg Keine Fehlfunktion / no malfunction Geht erfüllt seine bestimmungsgemäße Aufgabe. The equipment was seen to operate according to design requirements.	Keine Fehlfunktion / no malfunction Geht erfüllt seine bestimmungsgemäße Aufgabe. The equipment was seen to operate according to design requirements.
4.1.3.2	HF-Feld, pulsbreitenmoduliert Ersatzstrom Ersatzfeld, pulse modulated Spot frequency test	- IECEN 60255-22-3 (VDE 0435 T02-3) Klassen/Class III	80 MHz, 150 MHz, 300 MHz, 20 Vm (Ersatzwert, unmoduliert) (rms, unmodulated) 80 % AN; 1 kHz; t = 10 s	Amplitude, Wiederholungsrate - Hilfspulsfrequenz - Hilfspulsenergie - Hilfspulsleistung - Alle anderen Ein- und Ausgänge an other inputs and outputs 4 kV, 5 kV 4 kV, 5 kV	Kriterium / criterion A	Geprüft durch / tested by - PRO EMV GmbH, 15344 Strausberg Keine Fehlfunktion / no malfunction Geht erfüllt seine bestimmungsgemäße Aufgabe. The equipment was seen to operate according to design requirements.	Keine Fehlfunktion / no malfunction Geht erfüllt seine bestimmungsgemäße Aufgabe. The equipment was seen to operate according to design requirements.
4.1.3.3	HF-Feld, pulsbreitenmoduliert Ersatzstrom Ersatzfeld, pulse modulated Spot frequency test	- IECEN 60255-22-3 (VDE 0435 T02-3) Klassen/Class III	80 MHz, 150 MHz, 300 MHz, 20 Vm (Ersatzwert, unmoduliert) (rms, unmodulated) 80 % AN; 1 kHz; t = 10 s	Amplitude, Wiederholungsrate - Hilfspulsfrequenz - Hilfspulsenergie - Hilfspulsleistung - Alle anderen Ein- und Ausgänge an other inputs and outputs 4 kV, 5 kV 4 kV, 5 kV	Kriterium / criterion A	Geprüft durch / tested by - PRO EMV GmbH, 15344 Strausberg Keine Fehlfunktion / no malfunction Geht erfüllt seine bestimmungsgemäße Aufgabe. The equipment was seen to operate according to design requirements.	Keine Fehlfunktion / no malfunction Geht erfüllt seine bestimmungsgemäße Aufgabe. The equipment was seen to operate according to design requirements.

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4.1.10	Magnetfeld Power frequency magnetic field	- IECEN 61000-4-8 VDE 047 Teil 4-8 Klasse I IECEN 61000-4-6 VDE 047 Teil 4-6 VDE 0425	- 30 A/m dauernd / continuous; 50 Hz 200 A/m für 5 s / 50 Hz + 0.5 mT sinusförmig / sinusoidal; 50 Hz - 100 A/m dauernd / continuous; 50 Hz - 150 A/m	Kriteriumkriterien A	Keine Fehlfunktion / no malfunction Gerät erfüllt seine bestimmungsgemäße Aufgabe. The equipment was seen to operate according to design requirements. - Abweichung der Meßgrößen U und I Deviatio of measured values U and I ≤ 5 % Keine Fehlfunktion / no malfunction Gerät erfüllt seine bestimmungsgemäße Aufgabe. The equipment was seen to operate according to design requirements. Keine Messwertabweichung beobachtet no influence to measurements observed	
4.1.11	Magnetfeld, gepulst Pulsed magnetic field	- IECEN 61000-4-8 VDE 047 Teil 4-8 Klasse I Pulsformwelle shape 6.4 µs/16 µs 5 positive und 5 negative Stöße in Abständen von 10 s 5 positive and 5 negative shots at intervals of 10 s		Kriteriumkriterien B	Keine Fehlfunktion / no malfunction Gerät erfüllt seine bestimmungsgemäße Aufgabe. The equipment was seen to operate according to design requirements.	

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Prüfposition / Protocol Item	Prüfung / Test	Prüfbedingungen / Test condition / Operative range / Specifications	Prüfwert / Test values	Zulässige Toleranz / Grenzwerte / (Acc. to Techn. Data)	Prüfprotokoll / Test protocol / (Acc. to Techn. Data)	Test result / Remarks
4.1.5	Prüfung mit angeschlossenem Störstromnetz (SIRRE) Surge immunity test	- IECEN 60895-22-5 (VDE 0435 T3026) - IECEN 61000-4-5 (VDE 047 Teil 4-5) Instabilitätsklasse / stability class 3 Pulsformwelle shape 1.2 µs/50 µs 5 positive und 5 negative Stöße in Abständen von 10 s 5 positive and 5 negative shots at intervals of 10 s	Hilfsstromnetzversorgung power supply - Langzeitprüfmodus / common mode 2 kV; 10.2 9 µF - Querprüfung / differential mode 1 kV; 2.0; 18 µF Bündelstrahl und Messung / input heavy inputs and measuring inputs - Langzeitprüfmodus / common mode 1 kV; 2.0; 18 µF - Querprüfung / differential mode 1 kV; 2.0; 18 µF - Langzeitprüfmodus / common mode 4 kV; 2.0; 0.5 µF Amplitudenverstärker - Langzeitprüfmodus / common mode 2.5 kV (Schaltzeitpunkt) - Querprüfung / differential mode 2.5 kV (Schaltzeitpunkt) - Langzeitprüfmodus / common mode 1 MHz; $s = 15$ mA, RI = 200 Ω Wiederholungsrate / repetition 400 Hz Pulsdauer / pulse duration : 10 s	Kriteriumkriterien B	Keine Fehlfunktion / no malfunction Gerät erfüllt seine bestimmungsgemäße Aufgabe. The equipment was seen to operate according to design requirements.	
4.1.6	Gedächtnis Schwingung (IEEE) Oscillatory Surge Withstand Capability Test (IEEE)	- IEEE Std C37.90.1		Kriteriumkriterien B	Keine Fehlfunktion / no malfunction Gerät erfüllt seine bestimmungsgemäße Aufgabe. The equipment was seen to operate according to design requirements.	

TYPRÜFUNG - TYPE TEST
Transformatorerschutz V02.00
Transformer Protection V02.00

Ausgabe Edition 01
Datum Date 2012-11-23
Bericht Report TS1112-03
Blatt Sheet 0.6 - 79

Zusammenfassung
Summary

Prüfposition / Protocol Item	Prüfung / Test	Prüfbedingungen / Test condition / Operative range / Specifications	Prüfwert / Test values	Zulässige Toleranz / Grenzwerte / (Acc. to Techn. Data)	Prüfprotokoll / Test protocol / (Acc. to Techn. Data)	Test result / Remarks
4.1.12	Gedächtnis Schwingungen Oscillatory waves	- IECEN 61000-4-18 (VDE 047 Teil 4-18) Klasse 3	Lang- und Querprüfung common and differential mode 2.5 kV (Schaltzeitpunkt) beide Polaritäten both polarities 100 MHz, 1 MHz kein Puls / no pulse - Pulsformwelle / pulse shape nach VDE 047 Teil 4-18 RI = 200 Ω Langzeitprüfmodus / common mode test 2 kV (Schaltzeitpunkt) beide Polaritäten both polarities 0.4 MHz, 10 MHz, 30 MHz - 3 s min. RI = 50 Ω	Kriteriumkriterien B	Keine Fehlfunktion / no malfunction Gerät erfüllt seine bestimmungsgemäße Aufgabe. The equipment was seen to operate according to design requirements.	
4.1.7	Transiente Störgröße (IEEE) Fast Transient Surge Withstand Capability Test (IEEE)	- IEEE Std C37.90.1	Lang- und Querprüfung common and differential mode 4 kV Pulsformwelle shape 5 ns/50 ns beide Polaritäten / both polarities Burstpulsdauer / burst pulse duration: 10 ns Burstpulshöhe / burst pulse height: 300 ms Pulsdauer / pulse duration : 1 min beide Polaritäten / both polarities 150 MHz bis zu 90 MHz 10 V (Effektivwert, unmoduliert) (rms, unmodulated) 90 % AM, 1 MHz, RI = 150 Ω - 2 s min. / 2 s min. burst pulse Veränderung / change 2.5 s Frequenzschrittschaltfrequenz step frequency	Kriteriumkriterien B	Keine Fehlfunktion / no malfunction Gerät erfüllt seine bestimmungsgemäße Aufgabe. The equipment was seen to operate according to design requirements.	
4.1.8	Leistungsfähige hochfrequente Störungen, amplitudenmoduliert Frequenzschub Considered disturbances induced by radio frequency fields. Frequency sweep test	- IECEN 60895-22-6 (VDE 0435 T3026) - IECEN 61000-4-6 (VDE 047 Teil 4-6) Klasse II	Leistungsfähige hochfrequente Störungen, amplitudenmoduliert Frequenzschub Considered disturbances induced by radio frequency fields. Frequency sweep test	Kriteriumkriterien A	Keine Fehlfunktion / no malfunction Gerät erfüllt seine bestimmungsgemäße Aufgabe. The equipment was seen to operate according to design requirements.	
4.1.9	Leistungsfähige hochfrequente Störungen, amplitudenmoduliert Einfrequenzen Considered disturbances induced by radio frequency fields. Spot frequency test	- IECEN 60895-22-6 (VDE 0435 T3026) - IECEN 61000-4-6 (VDE 047 Teil 4-6) Klasse III	27 MHz, 68 MHz 10 V (Effektivwert, unmoduliert) (rms, unmodulated) 90 % AM, 1 MHz, 1 s 10 s	Kriteriumkriterien A	Keine Fehlfunktion / no malfunction Gerät erfüllt seine bestimmungsgemäße Aufgabe. The equipment was seen to operate according to design requirements.	



SIEMENS Infrastructure & Cities Sector Smart Grid Division Energy Automation		TYPPRÜFUNG - TYPE TEST Transformatorschutz V02.00 Transformer Protection V02.00		Zusammenfassung Summary		Ausgabe Edition 01 Datum Date 2012-11-23 Bericht Report TS1112-03 Blatt Sheet 0.6 - 02	
Prüfobjekt- position Product/Item	Prüfung Test	Prüfbedingung Test condition Voraussetzungen Specifications	Prüfwerte Test values	Zulässige Toleranz Conformance (ll. Techn. Daten) (Acc. to Techn. Data)	Permissible Tolerance Limiting values (Acc. to Techn. Data)	Prüfergebnis Test result Bemerkungen Remarks	Test result Remarks
4.2.3	Funktionsbedingte Noise field immunity	IEC 61010-1 EN 50171 (VDE 0225 Teil 1) Grenzwertklasse A	30 MHz bis 1 GHz Resonanzfrequenzmessung definiert 10 m Prüfung durchgeführt für Gerät in Ruhestellung und max. Wirkleistung 1/3 Schalt bis 1/1 Gerät Test performed for device in initial and max operated condition 1/3 up to 1/1 19 test device			Geprüft durch / tested by - PRO EBR GmbH, 15344 Strauberg Prüfung bestanden Test successfully passed	
5	Sicherheitsprüfungen Safety Tests						
5.1	Mechanische Festigkeit gegen Stoß und Schling Mechanical resistance to shock and impact	- IECEN 61010-1 (VDE 0411 Teil 1)					
5.1.1	Festigkeitsprüfung Rigidity test	- IECEN 61010-1 (VDE 0411 Teil 1) Anforderungen 6.2.1	Spannungszugstress Zugkraft von 10 N auf alle in Betrieb beschriebenen Teile. Test force with 10 N to every part of the enclosure which is accessible during operation			Geprüft durch / tested by - AUCOTEAM GmbH, 10407 Berlin - AUCOTEAM GmbH, 10407 Berlin Gerät erfüllt nach der Prüfung seine bestimmungsgemäße Aufgabe. The equipment was seen to operate according to design requirements after the test.	

SIEMENS Infrastructure & Cities Sector Smart Grid Division Energy Automation		TYPPRÜFUNG - TYPE TEST Transformatorschutz V02.00 Transformer Protection V02.00		Zusammenfassung Summary		Ausgabe Edition 01 Datum Date 2012-11-23 Bericht Report TS1112-03 Blatt Sheet 0.6 - 03	
Prüfobjekt- position Product/Item	Prüfung Test	Prüfbedingung Test condition Voraussetzungen Specifications	Prüfwerte Test values	Zulässige Toleranz Conformance (ll. Techn. Daten) (Acc. to Techn. Data)	Permissible Tolerance Limiting values (Acc. to Techn. Data)	Prüfergebnis Test result Bemerkungen Remarks	Test result Remarks
4.1.1.0	Subharmonische Überlastung Power frequency immunity	- IECEN 60525-2-7 (VDE 0435 70027) Klasse A	Erdungslängung auf DC-Busleitungsgro- nrote - Querschnitt/Differential mode 150 V/30 Hz bis 100 A and 0,1 µF - Langzeitstrommodus 300 V/30 Hz bis 220 A and 0,47 µF Stromspannungswechselspannung 24 V 4 V 80 V 125 V 250 V	Klassifizierung A		Externe Parallelwiderstand Externe Parallelresistor - 100 Ohm/100 W - 100 Ohm/100 W - 3,8 Ohm/100 W - 20 Ohm/100 W Keine Freiluftkühlung Gerät erfüllt seine bestimmungsgemäße Aufgabe. The equipment was seen to operate according to design requirements.	

SIEMENS Infrastructure & Cities Sector Smart Grid Division Energy Automation		TYPPRÜFUNG - TYPE TEST Transformatorschutz V02.00 Transformer Protection V02.00		Zusammenfassung Summary		Ausgabe Edition 01 Datum Date 2012-11-23 Bericht Report TS1112-03 Blatt Sheet 0.6 - 03	
Prüfobjekt- position Product/Item	Prüfung Test	Prüfbedingung Test condition Voraussetzungen Specifications	Prüfwerte Test values	Zulässige Toleranz Conformance (ll. Techn. Daten) (Acc. to Techn. Data)	Permissible Tolerance Limiting values (Acc. to Techn. Data)	Prüfergebnis Test result Bemerkungen Remarks	Test result Remarks
4.2	Störaussendung (Funkstörung) Emission (Radio frequency interference, RFI)	- IECEN 60525-26 - IECEN 61000-4 (VDE 0837 7E-4)	150 kHz bis 30 MHz Prüfung durchgeführt für Gerät in Ruhestellung und max. Wirkleistung 1/3 Schalt bis 1/1 Gerät Test performed for device in initial and max operated condition 1/3 up to 1/1 19 test device DC-UH = 24 V DC-UH = 48 V DC-UH = 200 V AC-UH = 230 V			Geprüft durch / tested by - PRO EBR GmbH, 15344 Strauberg Prüfung bestanden Test successfully passed	
4.2.1	Funktionsprüfung, beeinträchtigt am Fernkommunikations- kanal durch Störungen aus benachbarten Leitungen	- IEC 61011 - IEC 61011 (VDE 0225 Teil 1) Grenzwertklasse A					
4.2.2	Funktionsprüfung, beeinträchtigt am Telekommunikations- anschluss Conditioned disturbance at telecommunication port	- IEC 61011 - EN 50171 (VDE 0225 Teil 1) Grenzwertklasse A					

SIEMENS Infrastructure & Cities Sector Smart Grid Division Energy Automation		TYPPRÜFUNG - TYPE TEST Transformatorschutz V02.00 Transformer Protection V02.00		Zusammenfassung Summary		Ausgabe Edition 01 Datum Date 2012-11-23 Bericht Report TS1112-03 Blatt Sheet 0.6 - 01	
Prüfobjekt- position Product/Item	Prüfung Test	Prüfbedingung Test condition Voraussetzungen Specifications	Prüfwerte Test values	Zulässige Toleranz Conformance (ll. Techn. Daten) (Acc. to Techn. Data)	Permissible Tolerance Limiting values (Acc. to Techn. Data)	Prüfergebnis Test result Bemerkungen Remarks	Test result Remarks
4.2	Störaussendung (Funkstörung) Emission (Radio frequency interference, RFI)	- IECEN 60525-26 - IECEN 61000-4 (VDE 0837 7E-4)	150 kHz bis 30 MHz Prüfung durchgeführt für Gerät in Ruhestellung und max. Wirkleistung 1/3 Schalt bis 1/1 Gerät Test performed for device in initial and max operated condition 1/3 up to 1/1 19 test device DC-UH = 24 V DC-UH = 48 V DC-UH = 200 V AC-UH = 230 V			Geprüft durch / tested by - PRO EBR GmbH, 15344 Strauberg Prüfung bestanden Test successfully passed	
4.2.1	Funktionsprüfung, beeinträchtigt am Fernkommunikations- kanal durch Störungen aus benachbarten Leitungen	- IEC 61011 - IEC 61011 (VDE 0225 Teil 1) Grenzwertklasse A					
4.2.2	Funktionsprüfung, beeinträchtigt am Telekommunikations- anschluss Conditioned disturbance at telecommunication port	- IEC 61011 - EN 50171 (VDE 0225 Teil 1) Grenzwertklasse A					

SIEMENS Infrastructure & Cities Sector Smart Grid Division Energy Automation		TYPRÜFUNG - TYPE TEST Transformatorschutz V02.00 Transformer Protection V02.00				Ausgabe Edition 01 Datum Date 2012-11-23 Bericht Report TS1112.03 Blatt Sheet 0.6 - 84	
Problemposition Problem Item	Findung Find	Für Test	Fürbauung Abzählbereich Vorgaben	Test condition Operative range Specifications	Prüfwerte Test values	Zulassung Toleranz (UL Tech. Data)	Prüfung Bemerkungen
5.5	Laser- und IRED-Komponenten Laser and IRED devices		- IECEN 60825-1/2 - VDE 0837 T1.2	Test auf Einhaltung der angegebenen IRED-Klasse 1 Test of compliance with specified IRED class 1			Bestätigt durch Prüfung der technischen Daten / confirmed by checking of the technical data
5.6	Zulassungen Approvals		- UL 509				
5.6.1	UL Zulassung UL certification		Sicherheitsbestimmungen für Industriemaschinen Safety for Industrial Control Equipment			UL File Number: E184016	Die Geräte erfüllen im Rahmen der technischen Daten die US-amerikanischen und kanadischen Anforderungen. The devices are in compliance with U.S. and Canadian requirements with the values as stated in technical data. UL File E184016, volume 1, section 16

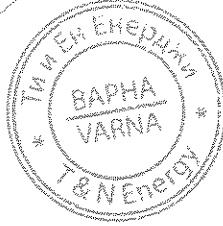
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ВАРНА С
ЭНЕРДЖИ
КОМПАНИЈА



SIEMENS

Division Energy Management
Digital Grid

TYPE TEST
TEST CERTIFICATE

Edition 06
Date 2016-07-22
Report TS0716-007
Sheet 2-1

Tested equipment Multifunction Protection Relays SIPROTEC 5



Product group: Transformer Differential Protection
7UT82, 7UT85, 7UT86, 7UT87

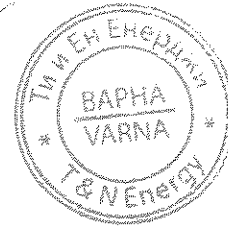
Firmware V07.30

Tests are according to: IEC/EN 60255 series, VDE 0435, IEC/EN 60870-2-1, IEC/EN 61000-6-2/4
IEEE Std C37.90.1/2, UL 508
Further standards s. specific tests

Performed tests: Properties at reference conditions

Test results: The equipment has successfully passed the type test. The equipment did not show any changes and was fully in order subsequent to these tests.

ВАРНО С
ОРИГИНАЛА



SIEMENS AG - EM DG PRO
Division Energy Management
Digital Grid

Place: EM DG PRO D
13629 Berlin (Siemensstadt)

Date: 2016-07-22

Tested by: Holzhauser



Signature



Reviewed by: Rochow



Signature

Test Report

Test Report Number: TS0816-001
Date of Issue: 2016-08-03

Subject:
Hardware Type Test for Product Family SIPROTEC 5, V07, Edition 03
For device types see range of validity

The tests were conducted by:
SIEMENS AG
R&D, Type Test Department
EM DG PRO D DS TT
Weinmweidamm 5
13629 Berlin
Germany

external tests
see subcontracting

The tests were conducted for (client):
SIEMENS AG
Products
EM DG PRO LM PR
Humboldtstrasse 59
90459 Nuremberg
Germany

This Test Report consists of 56 pages.

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Template: TTR_TMP.doc

AS3600-07310-T613-01-76A1

version: 1.22

Hardware Type Test Product Family SIPROTEC 5, V07
For device types see range of validity

Applied Standards: IEC/EN 60255 series, VDE 0435, IEC/EN 61000-6-2/4/5
IEEE Std C37.90.1/2, UL 508
further standards & specific tests

- Performed tests:
- 1 Ratings at reference conditions
 - 2 Product safety tests
 - 3 Environmental tests
 - 4 Electromagnetic compatibility tests
 - 5 Approvals

Test results: The equipment has successfully passed the type test. The equipment did not show any changes and was fully in order subsequent to these tests.

SIEMENS AG - EM DG PRO
Energy Management Division
Digital Grid

Place: EM EA PRO D DS TT
13629 Berlin (Siemensstadt)
Germany

Date: 2016-08-03



Tested: Eckelmann, Florian

Reviewed: Rochow, Norbert

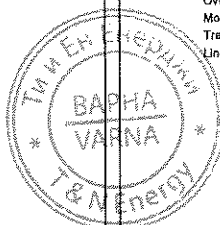
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Scope of protocol

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0.1 Certificate	1
0.2 Range of validity	5
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ВЯРНО С
ОРИГИНАЛА



Range of validity

SIPROTEC 5 devices:

Product designation of modular devices

Basic devices

Line Protection	7SA84, 7SA86, 7SA87 7SD84, 7SD86, 7SD87 7SL86, 7SL87
Generator Protection	7UM85
Breaker Management	7VK87
Overcurrent Protection	7SJ85, 7SJ86
Bay Control Unit	6MD85, 6MD86
Transformer Protection	7UT85, 7UT86, 7UT87
Railway Protection	7ST85
Fault Recorder	7KE85
Motor Protection	7SK85
Busbar Protection	7SS85

Replacement base modules

Line Protection	ESL84, ESL86, ESL87
Bay Control Unit	EMD85, EMD86
Transformer Protection	EUT87
Railway Protection	EST85
Overcurrent Protection	ESJ85
Motor Protection	ESK85
Fault Recorder	EKE85

Product designation of non-modular devices

Overcurrent Protection	7SJ82
Motor Protection	7SK82
Transformer Protection	7UT82
Line Protection	7SA82, 7SD82, 7SL82

Signature

Range of validity

SIPROTEC 5 Platform and Hardware Characteristics

The SIPROTEC 5 series includes both modular and non-modular devices. Modular devices consist of a base module (1/3 of 19 inches) and can be expanded with expansion modules (1/6 of 19 inches). The device type identifier for modular devices is XXX85, XXX86 or XXX87, for example, 7SA86

Type XXX84 devices have the same hardware properties as the modular devices, but they cannot be expanded with expansion modules.

All non-modular devices consist of just a base module (1/3 of 19 inches) and cannot be expanded with expansion modules (1/6 of 19 inches). The device type identifier for non-modular devices is 7XX82, for example, 7SJ62.

Hardware Characteristics of Modular Devices

A modular device always consists of a base module and optionally of expansion modules. The modules can be chosen according to hardware characteristics. These characteristics are:

- Module size
- Type of construction
- Mounting of the on-site operation panel
- Layout (or design) of the on-site operation panel
- Input and output module
- Plug-in modules

The modules are available in 2 sizes:

- Base module (1/3 of 19 in)
- Extension module (1/6 of 19 in)

The devices are available in 3 designs:

- Flush-mounting devices with on-site operation panel fitted directly on the device
- Surface-mounting devices with integrated on-site operation panel
- Surface-mounting devices with detached on-site operation panel

The on-site operation panels of the base modules can be selected from 3 variants:

- With a large display, keypad, and 16 2-colored LEDs
- With a small display, keypad, and 16 2-colored LEDs
- Without a display, without a keypad (standard), but with 16 2-colored LEDs

The on-site operation panels of the extension modules can be selected from 3 variants:

- With 16 1-colored LEDs and 2 key switches
- With 16 1-colored LEDs
- Without display elements



The base module always contains the central processor board CP200/CP300, the power-supply module PS201 and an input and output module IO2XX.
The extension module contains an input and output module IO2XX or a plug-in module assembly with integrated power supply CB202.
The 1st extension module in the 2nd device row always contains the power supply module PS203.

The plug-in modules are available for various applications. The following plug-in modules can be installed in the base module or in an extension module with plug-in module assembly with integrated power supply CB202:

- Communication module
- Measuring-transducer module

Hardware Characteristics of Non-Modular Devices

A non-modular device always consists of just one module (1/3 of 19 inches) and cannot be expanded with expansion modules (1/6 of 19 inches). These hardware characteristics are:

- Module size: 1/3 of 19 in.
- Type of construction: Flush-mounting devices with on-site operation panel fitted directly on the device

The on-site operation panels can be chosen from 2 variants:

- With a large display, keypad, and 16 2-colored LEDs
- With a small display, keypad, and 16 2-colored LEDs

The module always contains the central processor board CP100, the power supply module PS101 and an input and output module IO10X. The input and output module IO10X includes the terminals for current and voltage transformers.

Optionally, the module can be equipped with an additional input and output module IO110 for extra binary inputs and outputs.

The plug-in modules are available for various applications. The following plug-in modules can be installed in the module:

- Communication modules
- Measuring-transducer modules

Range of validity

All hardware type tests were performed at various combinations with all modules of the SIPROTEC 5 platform. Therefore all realized devices were covered:

SIPROTEC 5

Functional description of boards for modular devices

Module	Functional description
PS203	Power Supply Board for the 2 nd device row, (DC: 24 V/48 V or 60 V to 250 V and AC: 100 V to 230 V), mounted in 1/6 19-inch size housing
CB202	Plug-in module assembly, including an additional power supply, (DC: 24 V/48 V or 60 V to 250 V and AC: 100 V to 230 V), mounted in 1/6 19-inch size housing
CP200	Processor (Single Core CPU) Board, mounted into the front cover of the 1/3 19-inch size housing, different variants for the available device designs
CP300	Processor (Dual Core CPU) Board, SD-Slot, mounted into the front cover of the 1/3 19-inch size housing, different variants for the available device designs
IO201	Input Output Module, 4 current inputs, 8 binary inputs, 6 binary outputs, reduced assembled variant of IO202
IO202	Input Output Module, 4 current measuring inputs, 4 voltage measuring inputs, 8 binary inputs, 6 binary outputs, mounted in 1/6 or 1/3 19-inch size housing
IO203	Input Output Module, 8 current measuring inputs, 4 binary inputs, 4 binary outputs, mounted in 1/6 19-inch size housing
IO204	Input Output Module, 10 binary inputs, 4 binary outputs, 4 power relays for controlling 2 motors, mounted in 1/6 19-inch size housing
IO205	Input Output Module, 12 binary inputs, 16 binary outputs, mounted in 1/6 19-inch size housing
IO206	Input Output Module, 6 binary inputs, 7 binary outputs, mounted in 1/6 19-inch size housing, reduced assembled variant of IO205
IO207	Input Output Module, 16 binary inputs, 8 binary outputs, mounted in 1/6 19-inch size housing
IO208	Input Output Module, 4 current measuring inputs, 4 voltage measuring inputs, 4 binary inputs, 11 binary outputs, mounted in 1/3 or 1/6 19-inch size housing
IO209	Input Output Module, 8 binary inputs, 4 High Speed Outputs, mounted in 1/6 19-inch size housing
IO210	Input Output Module, 4 current measuring inputs, 3 voltage measuring inputs, 7 binary outputs, 4 high-speed transducer inputs current/voltage, mounted in 1/6 19-inch size housing
IO211	Input Output Module, 8 voltage measuring inputs, 8 binary inputs, mounted in 1/6 or 1/3 19-inch size housing
IO212	Input Output Module, 8 binary inputs, 8 high-speed transducer inputs current/voltage, mounted in 1/6 19-inch size housing
IO214	Input Output Module, 4 current measuring inputs, 4 voltage measuring inputs, 2 binary inputs, 5 binary outputs, mounted in 1/6 or 1/3 19-inch size housing, reduced assembled variant of IO202
IO215	Input Output Module, 4 current measuring inputs, 4 voltage measuring inputs (designed for a measuring range up to 7.07 V) 8 binary inputs, 6 binary outputs, mounted in 1/6 or 1/3 19-inch size housing
IO230	Input Module, 48 binary inputs, mounted in 1/6 19-inch size housing
IO231	Input Output Module, 24 binary inputs and 24 binary outputs
PB201	Process-Bus Module, 7 LC Duplex interfaces of which 1 is a service port, mounted in 1/6 19-inch size housing

Range of validity

Functional description of boards for non-modular devices

Board	Functional description
IO101	Input Output Board, 4 current inputs, 8 binary inputs, 6 binary outputs, reduced assembled variant of IO102
IO102	Input Output Board, 4 current inputs, 4 voltage inputs, 8 binary inputs, 6 binary outputs
IO103	Input Output Board, 6 current inputs, 4 binary inputs, 4 binary outputs
IO110	Input Output Board, 12 binary inputs, 7 binary outputs

Functional description of plug-in modules for modular devices and for non-modular devices

Plug-in module	Functional description
USART-xx ¹ -y ² EL	Serial communication module, electrical connection
USART-xx ¹ -y ² FO	Serial communication module, optical connection
USART-xx ¹ -y ² LDFO	Serial communication module for long distances, optical connection
ETH-xx ¹ -2EL	Ethernet module, electrical connection
ETH-xx ¹ -2FO	Ethernet module, optical connection
ANAL-CA-4EL	Measuring-transducer module
ARC-CD-3FO	Arc Protection module

Valid for all firmware and DIGSI versions.

ВЪРНО С
ОРИГИНАЛА

ТИМ ЕН ЕНЕРДЖИ
ВАРНА
T & Energy

1 2 letters, unique code of the Module in the product code of the device
2 1 = 1 channel, 2 = 2 channels

921

Scope of editions

Edition	Date	Modifications or supplements compared to the former edition
1	2016-01-06	First edition for SIPROTEC 5 Platform Version 07 with devices and boards according "Range of validity"
2	2016-07-21	Second edition for SIPROTEC 5 Platform with updates regarding V7.30 release (I0210, new test reports)
3	2016-08-03	Third edition with update regarding IP-Rating (IEC 60529)

Overview of external test labs and test reports

EMC Test laboratories	Test report number
PRO EMV Labor Strausberg GmbH (Dakks: D-PL-12052-01-00) Garzauer Chaussee 15344 Strausberg Germany	PLE100502 PLE100621 PLE100720 PLE101213 PLE101214 PLE110116 PLE110117 PLE110204 PLE110501 PLE110825 PLE120513 PLE120803 PLE121006 PLE130105 PLE130216 PLE130601 PLE130807 PLE130809 PLE130802 PLE130921 PLE131210 PLE140415 PLE140509 PLE140911 PLE140918 PLE141104 PLE150810 PLE150818
<i>For more details about these reports see</i> "Technical Statement in accordance with the EMC Directive 2004/108/EEC inclusive all modifications" by PRO EMV Labor Strausberg GmbH, dated 2015-10-16	
Eurofins Product Service GmbH (A2LA: 1963.00 / Dakks : D-PL-12092-01-00) Storkower Str. 38c 15526 Reichenwalde Germany	G0M-1507-4895-EE02-V01 G0M-1503-4617-EE01-V02 G0M-1604-5556-Er01GEN-V01

Environmental test laboratories Test report number

AUCOTEAM GmbH Berlin (Dakks: D-PL-19102-01-00) Storkower Str. 115 a 10407 Berlin Germany	6892 / 08 6893 / 08 6894 / 08 6895 / 08 6736.03 / 08 7156 / 09 7352 / 09 7763 / 10 7779 / 10 7826.01 / 10 7829.01 / 10 7829 / 10 7862 / 10 7827.01 / 10 7827.02 / 10 8122 / 10 8325 / 11 9291 / 12 9577 / 12 9752 / 13 9760 / 13 9830 / 13 9885 / 13 9889 / 13 10034 / 13 10093 / 13 10094 / 13 10077.02 / 13 10134 / 13 10478.01 / 14 10478.02 / 14 10569 / 14 11605 / 15
<i>For more details about these reports see</i> "Technical Statement on environmental tests according IEC 60068 and IEC 60255" by AUCOTEAM GmbH Berlin, dated 2015-10-15	

RST Rail System Testing GmbH Umweltprüflabor (Dakks: D-PL-11012-01) Walter-Kleinow-Ring 7 16761 Hennigsdorf Germany	P50-06-0057 P50-09-0102 P50-10-0111 P50-15-0191 P50-15-0376 P50-16-0239
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TZO Labor für Umwelterprobung und Werkstoffprüfung (Dakks: D-PL-11034-01-00)	151/10
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Transportation stress tests	
SCUS Servicecenter Umweltsimulation (Dakks: D-PL-11195-01-00) Heidelberger Str. 20 01189 Dresden Germany	100415-01 100416-01

VDZ GmbH (VDA authorized) Gieselherstraße 34 44319 Dortmund Germany	060410 20141030
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Product Safety Tests Test report number

iTps Institute for International Product Safety (listed in ALPHA and LOVAG register under Identity Number D 01) PyroLaboratorium Bonn Hein-Moeller-Str. 7-11 53115 Bonn Germany	1001769 1001770 1001773 1001774 1001775 1001777
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DNV GL - KEMA Test Lab (RVA: L218) Ulrechtseweg 310 6800 ET, Arnhem The Netherlands	1250-15 V1
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Eurofins Product Service GmbH (A2LA: 1963.00 / Dakks : D-PL-12092-01-00) Storkower Str. 38c 15526 Reichenwalde Germany	G0M-1411-4316-SEC027N-V02 G0M-1411-4317-SEC027N-V03
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Analytic test of material Prüflabor Helmut W. E. Lüdemann Labor für Instrumentelle Analytik Heinrich-Hertz-Str. 16 23909 Ratzeburg Germany	Report no.: 6829
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UL / CSA Certification UL International Germany GmbH 63263 Neu-Isenburg Germany	Report Reference for modular devices: File E194016, volume 1, section 16 Report Reference for non-modular devices: File E194016, volume 1, section 22
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Technical Information; Technical data

Technical Information; Description:

Manual		Edition	
1.	SIPROTEC 5 Schutzgeräte Produktinformation	Bestell-Nr. C53000-B5000-C001	German
2.	SIPROTEC 5 Protection Devices Product Information	Part No. C53000-B5040-C001	English
3.	SIPROTEC 5 Hardware Handbuch	Bestell-Nr. C53000-G5000-C002	German
4.	SIPROTEC 5 Hardware Manual	Part No. C53000-G5040-C002	English
5.	SIPROTEC 5 Betrieb Handbuch	Bestell-Nr. C53000-G5000-C003	German
6.	SIPROTEC 5 Operating Manual	Part No. C53000-G5040-C003	English
7.	SIPROTEC 5 Gerätehandbücher		German
8.	SIPROTEC 5 Device Manuals		English

For the technical data see the description (Technical Information).

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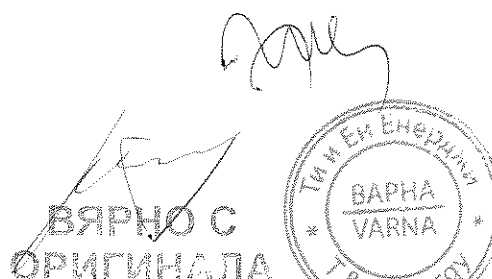
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SIEMENS Energy Management Division Digital Grid		TYPE TEST Product Family SIPROTEC 5, V07		Edition Date Report Sheet	
		Summary		03 2016-08-03 TS0816-001 0.6 - 3	
Protocol Item	Test	Test condition Operative range Specifications	Test values	Permissive Tolerance Limiting values	Test result Remarks
1.1.4	Binary inputs	each output relay	Power input at DC, V _{nom} ± V; 300 V	P ≤ 0.5 W	0.3 W
1.1.4.1	Selectable pickup threshold Limits (with DIGSI)	for rated control voltage range	Operating Voltage DC 24 V, 48 V and 60 V	LDV = 40 % of rated control voltage HGH = 60 % of rated control voltage	DC I approx. 0.6 to 1.0 mA (omnibus)
		Range 1	Operating Voltage DC 110 V and 125 V	V _{DCnom} ± 10 V V _{DCmin} ± 18 V	
		Range 2	Operating Voltage DC 220 V and 250 V	V _{DCnom} ± 44 V V _{DCmin} ± 88 V	
		Range 3	V _{DC} 0.80 ≤ V/V _N ≤ 1.20 V _{AC} 0.80 ≤ V/V _N ≤ 1.15 at 0.95 ≤ I/I _N ≤ 1.05	V _{DCnom} ± 88 V V _{DCmin} ± 176 V	
1.2	Limits of operation	at all extremely hard zones	supervision of all internal voltages	V _{DC} 0.80 ≤ V/V _N ≤ 1.20 V _{AC} 0.80 ≤ V/V _N ≤ 1.15	No influence on the accuracy and function, no reaction on the internal voltage supervision
1.3	Switching on/off	- IEC 60254 - VDE 0435-500		3 A circuit breaker, characteristic C according to IEC 60898 must not trip	No misoperation

SIEMENS Energy Management Division Digital Grid		TYPE TEST Product Family SIPROTEC 5, V07		Edition Date Report Sheet	
		Summary		03 2016-08-03 TS0816-001 0.6 - 1	
Protocol Item	Test	Test condition Operative range Specifications	Test values	Permissive Tolerance Limiting values	Test result Remarks
0	General				
0.1	Standards	For the date references of the standards, only the edition cited applies. For unabled references, the currently published edition at the date of issue for this type test protocol applies.			
1	Ratings of reference conditions	reference conditions - VDE 0435-500 - IECEN 60254 table 1.2			- Siemens Product Service GmbH Ruhradwald, Germany Test passed see Report GDM-1411-4316-SEC027A-V02 see Report GDM-1411-4317-SEC027A-V03
1.1	Burden / Power Consumption	- VDE 0435-500 - IEC 60254-1, Section 6.10	Burden at the terminals of current input		Phase-modular and sub-modular devices
1.1.1	Current inputs	I _N = 1 A and I ₀ = 5 A			Related to I ₀ / Phase S approx. 0.1 VA
1.1.1.1	Protection transformer inputs	I _N = 1 A and I ₀ = 5 A			Related to I ₀ / Phase S approx. 0.1 VA
1.1.1.2	Instrument transformer inputs	I _N = 1 A and I ₀ = 5 A			Related to I ₀ / Phase S approx. 0.1 VA

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		Summary		03 2016-08-03 TS0816-001 0.6 - 4	
Protocol Item	Test	Test condition Operative range Specifications	Test values	Permissive Tolerance Limiting values	Test result Remarks
1.4	Temperature	- IECEN 60254-1 - VDE 0435-500 For all functions	-10 °C ≤ Tamb ≤ +55 °C	± 0.5 %/10 K	0.2 %/10 K Deviation from measured value at reference conditions
1.5	Frequency	- IECEN 60254-1 - VDE 0435-500 For all functions	0.95 · f _N ≤ +1.05		No additional deviation detected, influence negligible

SIEMENS Energy Management Division Digital Grid		TYPE TEST Product Family SIPROTEC 5, V07		Edition Date Report Sheet	
		Summary		03 2016-08-03 TS0816-001 0.6 - 2	
Protocol Item	Test	Test condition Operative range Specifications	Test values	Permissive Tolerance Limiting values	Test result Remarks
1.1.2	Voltage inputs	V _N = V _N = 57.735 V in L-N	Burden at L1, L2, L3 and Ven, V4, V5	S ≤ 0.1 VA @ 57.735 V/Phase	at 57.735 V S ca. 0.02 VA/Phase S approx. 0.02 VA/Phase
1.1.3	Auxiliary supply voltage and power consumption	modular devices non-modular devices	modular devices in quiescent state non-modular devices in quiescent state modular devices only modular devices only	P ≤ 15 W S ≤ 40 VA S ≤ 20 VA P ≤ 8 W S ≤ 20 VA S ≤ 15 VA P ≤ 5 W S ≤ 9 VA P ≤ 5 W S ≤ 20 VA S ≤ 10 VA P ≤ 5 W S ≤ 10 VA P ≤ 2 W	- DC 24 V/48 V - DC 80 V to 230 V and AC 100 V to 230 V, 50/60 Hz - DC 24 V/48 V - DC 80 V to 125 V - DC 110 V to 250 V and AC 100 V to 230 V, 50/60 Hz approx. 13 W 33 VA @ 230 V/50 Hz 24 VA @ 115 V/50 Hz 7 W 15 VA @ 230 V/50 Hz 11.5 VA @ 115 V/50 Hz 3 W 6 VA @ 115 V / 230 V/50 Hz 3.5 W 14 VA @ 230 V/50 Hz 7 VA @ 115 V/50 Hz approx. 3.5 W 6 VA @ 115 V / 230 V/50 Hz 1.5 W

SIEMENS Energy Management Division Digital Grid		TYPE TEST Product Family SIPROTEC 5, V07		Edition Date Report Sheet	
		Summary		03 2016-08-03 TS0916-001 0.6 - 7	
Protocol Item	Test	Test condition Operative range Specifications	Test values	Permissible Tolerance Limiting values	Test result Remarks
2.1.3	Impulse voltage withstand test	- IECEN 60255-5 - IECEN 60255-27 - IECEN 60970-2-1 - VDE 0453-327 - IEEE S8C C37.50	5 kV (peak value), 1.2 μs/50 μs, 0.5 J 5 positive and 5 negative shots at intervals of 1 s 6 kV (peak value), 1.2 μs/50 μs, 0.5 J 5 positive and 5 negative shots at intervals of 1 s 1 kV (peak value), 1.2 μs/50 μs, 0.5 J 5 positive and 5 negative shots at intervals of 1 s	Common-mode all circuits (except serial interfaces) differential-mode all circuits (except relay contacts) components designed for double/reinforced insulation Common-mode Substituted serial shielded interfaces only	Tested by: - DNV GL - Energy KEMA Laboratories, Arnhem Test passed (see KEMA Report 1200-15 V1) - Euronics Product Service GmbH Reichenwald, Germany Test passed (see IECEN 60255-5) see Report GOM-1411-4316-SEC027N-V02 see Report GOM-1411-4317-SEC027N-V03 The observed equipment had operated according to design requirements after test.

SIEMENS Energy Management Division Digital Grid		TYPE TEST Product Family SIPROTEC 5, V07		Edition Date Report Sheet	
		Summary		03 2016-08-03 TS0916-001 0.6 - 5	
Protocol Item	Test	Test condition Operative range Specifications	Test values	Permissible Tolerance Limiting values	Test result Remarks
2.1	Insulation	For all functions - IECEN 60255-5 - IECEN 60255-27 - IECEN 60970-2-1 - VDE 0453-327 - IEEE S8C C37.50	Clearances and creepage distances between all external circuits to each other and to the enclosure; Clearances and creepage distances between all external circuits to the internal electronic circuit	4 mm 6 mm	- Euronics Product Service GmbH Reichenwald, Germany Test passed see Report GOM-1411-4316-SEC027N-V02 see Report GOM-1411-4317-SEC027N-V03
2.1.1	Clearances and creepage distances	- IECEN 60255-5 - IECEN 60255-27 - VDE 0453-327 - IECEN 61010-1			confirmed confirmed

SIEMENS Energy Management Division Digital Grid		TYPE TEST Product Family SIPROTEC 5, V07		Edition Date Report Sheet	
		Summary		03 2016-08-03 TS0916-001 0.6 - 8	
Protocol Item	Test	Test condition Operative range Specifications	Test values	Permissible Tolerance Limiting values	Test result Remarks
2.2	Protection against electric shock	- IECEN 60255-5 - IECEN 60255-27	DC 500 V > 100 MΩ DC 500 V > 10 MΩ tested acc. to IEC 61131-2 Item 12.2.2 30 A/ 2 mm G.U.D	all circuits all circuits ≤ 0.1 Ω	Tested by: - Euronics Product Service GmbH Reichenwald, Germany Test passed see Report GOM-1411-4316-SEC027N-V02 see Report GOM-1411-4317-SEC027N-V03 Insulation resistance > 100 MΩ > 10 MΩ The requirements are met at all test points all testable parts against housing
2.2.1	Measurement of insulation resistance	for devices in a new condition after clamp test test: 10 days			
2.2.2	Protective bonding test	- IECEN 61140 - VDE 0140-1 Protection class 1			
2.3	Flammability	- IECEN 60255-1 - IECEN 60255-27 - VDE 0453-300			confirmed max. temperature rise at enclosure: ΔT ≤ 10 K No damage; The observed equipment had operated according to design requirements after the test.
2.3.1	Equipment temperature limits and protection against spread of fire		max. permissible continuous input values max. permissible continuous input current of rapid energy	Temperature of accessible parts & enclosure < 70 °C at an ambient temperature of 40 °C	

SIEMENS Energy Management Division Digital Grid		TYPE TEST Product Family SIPROTEC 5, V07		Edition Date Report Sheet	
		Summary		03 2016-08-03 TS0916-001 0.6 - 5	
Protocol Item	Test	Test condition Operative range Specifications	Test values	Permissible Tolerance Limiting values	Test result Remarks
2.1.2	Dielectric test	- IECEN 60255-5 - IECEN 60255-27 - IECEN 60970-2-1 - VDE 0453-300 - IEEE S8C C37.50	AC 2.5 kV, 50 Hz, 1 min DC 3.5 kV, 30 s each polarity DC 700 V, 30 s each polarity AC 2.5 kV, 50 Hz, 1 min	all circuits except auxiliary dc voltage input, binary inputs and serial interfaces auxiliary voltage input and binary inputs only isolated serial interfaces components designed for double/reinforced insulation	Tested by: DNV GL - Energy KEMA Laboratories, Arnhem Test passed (see KEMA Report 1200-15 V1) - Euronics Product Service GmbH Reichenwald, Germany Test passed see Report GOM-1411-4316-SEC027N-V02 see Report GOM-1411-4317-SEC027N-V03 No flash-over or breakdown; The observed equipment had operated according to design requirements after test.

SIEMENS Energy Management Division Digital Grid		TYPE TEST Product Family SIPROTEC 5, V07		Summary		Edition Date Report Sheet	
						03 2016-09-03 TS0816-001 0.6 - 11	
Protocol Item	Test	Test condition Operative range Specifications	Test values	Permissible Tolerance Limiting values	Test result Remarks		
2.1	Load capacity	- IEC 60285-27 - VDE 0435-27					
2.1.1	Current circuits, thermal short-time range		$I_N = 1 A, I_{th} = 6 A$		No damage ; The observed equipment had operated according to design requirements after test.		
2.1.1.1	Standard inputs (protection-class current transformer)	In L1, L2, L3, N: 4 h, continuous 5 h, for 3 min 5 h, for 2 min 30 h, for 10 s 100 h, for 1 s					
2.1.1.2	Pre-load for high-sensitive earth fault detection (instrument transformers)	In L1, L2, L3, N: 4 h, continuous 5 h, for 3 min 5 h, for 2 min 30 h, for 10 s 100 h, for 1 s	$I_N = 1 A, I_{th} = 5 A$		Tested by: - DNV GL - Energy - KEMA Laboratories, Arnhem Test passed (see KEMA Report 1290-19 V1) No damage ; The observed equipment had operated according to design requirements after test. - Eurofins Product Service GmbH - Eurofins Product Service GmbH - Eurofins Product Service GmbH Test passed see Report GDM-1411-0316-SEC027AV02 see Report GDM-1411-0317-SEC027AV03		

SIEMENS Energy Management Division Digital Grid		TYPE TEST Product Family SIPROTEC 5, V07		Summary		Edition Date Report Sheet	
						03 2016-09-03 TS0816-001 0.6 - 9	
Protocol Item	Test	Test condition Operative range Specifications	Test values	Permissible Tolerance Limiting values	Test result Remarks		
2.2	Flammability of materials and components	- IEC 60285-27 - VDE 0435-27 - UL94V0	Limit = 40 °C, full load operation Limit = 70 °C Subsequent state Stress duration: t = 8 h		No damage; no ascending of critical temperatures for components The observed equipment had operated according to design requirements after test.		
2.4	Wrong Polarity	- IEC 60285-27 Wrong polarity for versions with $V_N = DC: 24V, 48V$ $V_N =$ DC: 60 V, 110 V, 120V, 220 V, 250V	Check if incorrect polarity of the primary supply voltage may lead to the internal device fuse blowing.		No damage; no ascending of critical temperatures for components		
2.5	Laser and IRED devices	- IEC 60285-27 - VDE 0827 T12	Test of compliance with specific IRED class 1		confirmed by checking of manufacturer's technical data		

SIEMENS Energy Management Division Digital Grid		TYPE TEST Product Family SIPROTEC 5, V07		Summary		Edition Date Report Sheet	
						03 2016-08-03 TS0816-001 0.6 - 12	
Protocol Item	Test	Test condition Operative range Specifications	Test values	Permissible Tolerance Limiting values	Test result Remarks		
2.1.2	Voltage circuits	230 V continuous IO102, IO202, IO208, IO211, IO214 20 V continuous IO215	230 V continuous 20 V continuous		Tested by: - DNV GL - Energy - KEMA Laboratories, Arnhem Test passed (see KEMA Report 1290-15 V1) - Eurofins Product Service GmbH - Eurofins Product Service GmbH - Eurofins Product Service GmbH Test passed see Report GDM-1411-0316-SEC027AV02 see Report GDM-1411-0317-SEC027AV03 No damage ; The observed equipment had operated according to design requirements after test.		

SIEMENS Energy Management Division Digital Grid		TYPE TEST Product Family SIPROTEC 5, V07		Summary		Edition Date Report Sheet	
						03 2016-08-03 TS0816-001 0.6 - 10	
Protocol Item	Test	Test condition Operative range Specifications	Test values	Permissible Tolerance Limiting values	Test result Remarks		
2.6	Mechanical resistance against shock and impact	- IEC 61010-1 - VDE 0411 Teil 1	Test force with 20 N to any part of the equipment which is accessible during operation		tested by - AUCOTEM GmbH, 10407 Berlin The observed equipment had operated according to design requirements after the test.		
2.6.1	Rigidity test	- IEC 61010-1 - VDE 0411 Teil 1	Stress: 3 hits with an energy of 5 J to all parts which are accessible in normal use		tested by - AUCOTEM GmbH, 10407 Berlin The observed equipment had operated according to design requirements after the test.		
2.6.2	Impact hammer test	- IEC 61010-1 - VDE 0411 Teil 1	modular and non-modular devices: front side: IP54 rear side (terminals attached): IP20		tested by - Eurofins Product Service GmbH - Eurofins Product Service GmbH - RST Rail System Testing GmbH - Heminger, Germany		
2.7	Protection degree provided by enclosure	- IEC 60529 - VDE 0470 Teil 1			- AUCOTEM GmbH, Berlin, Germany Test passed The observed equipment had operated according to design requirements after the test.		

SIEMENS Energy Management Division Digital Grid		TYPE TEST Product Family SIPROTEC 5, V07		Summary		Edition Date Report Sheet	
						03 2016-08-03 TS0816-001 0.6 - 15	
Protocol Item	Test	Test condition Operative range Specifications	Test values	Permissible Tolerance Limiting values	Test result Remarks		
2.8.4	Power relays (for Direct Control of Motor Subsets)	- IEC61810/10-1 - VDE 0435-201 - IEC61810/5-1 - VDE 0435-300 - IEEE Std C37.90 - IEEE Std C37.90	Switching capacity make-break 250 V 1000 W 250 V 1000 W 110 V 1000 W 60 V 600 W 48 V 480 W 24 V 240 W switching voltage ACDC 250 V max. ON time 30 s recovery time before switching on again 15 min Short-time capacity make and carry 30 A for 0.2 s ON 15 s OFF number of operations ≥ 2000 make and carry 30 A for 1 s number of operations at least 1 Short-time current across closed contact 250 A for 30 ms 3 operations with an interval of 10 s		No damage: The observed equipment had operated according to design requirements after test. No damage: The observed equipment had operated according to design requirements after test. No damage: The observed equipment had operated according to design requirements after test. No damage: The observed equipment had operated according to design requirements after test.		

SIEMENS Energy Management Division Digital Grid		TYPE TEST Product Family SIPROTEC 5, V07		Summary		Edition Date Report Sheet	
						03 2016-08-03 TS0816-001 0.6 - 13	
Protocol Item	Test	Test condition Operative range Specifications	Test values	Permissible Tolerance Limiting values	Test result Remarks		
2.8.3	Output relays, contact performance (Standard Relay Type S, Fast Relay Type F, High-Speed Relay with Semiconductor Acceleration Type HS)	- IEC61810/10-1 - VDE 0435-201 - IEC61810/5-1 - VDE 0435-300 - IEEE Std C37.90	Short-time capacity with 10 000 cycles switching capacity make 1000 WVA @ U _{IP} = 40 ms for all Types break 30 WVA @ U _{IP} = 40 ms for Type S and F break 1000 WVA for Type HS switching voltage ACDC 250 V for Type S and F AC 230 V, DC 250 V for Type HS permissible current continuous: 5A		No damage: The observed equipment had operated according to design requirements after test. Tested by: DNV GL - Energy REDA Laboratories, Aachen Test Protocol (see IEMA Report 1250-15 V1) ; Eurofime Product Service GmbH Rachshaus, Germany Test passed see Report COM-1411-4316-SEC027N-V02 see Report COM-1411-4317-SEC027N-V03		

SIEMENS Energy Management Division Digital Grid		TYPE TEST Product Family SIPROTEC 5, V07		Summary		Edition Date Report Sheet	
						03 2016-08-03 TS0816-001 0.6 - 16	
Protocol Item	Test	Test condition Operative range Specifications	Test values	Permissible Tolerance Limiting values	Test result Remarks		
2.8.1	Binary inputs	- IEC61810/5-1 - VDE 0435-207	DC: 60 V DC: 150 V DC: 300 V continuous Surge current impulse, 1 cycle with I _m = 100 A	Range 1 Range 2 Range 3	No damage: The observed equipment had operated according to design requirements after test. No damage: The observed equipment had operated according to design requirements after test. No damage: The observed equipment had operated according to design requirements after test.		
2.9	Surge current withstand test	- IEC 60254 - IEC61810/5-1 - VDE 0435-207					
2.8.1	Standard inputs (protection-class current transformers)	IL, L2, L3, N I _m = 250 A (test cycle)					
2.8.2	In-Input for high-sensitive earth fault detector (instrument transformers)	IL, L2, L3, N I _m = 250 A (test cycle)					

SIEMENS Energy Management Division Digital Grid		TYPE TEST Product Family SIPROTEC 5, V07		Summary		Edition Date Report Sheet	
						03 2016-08-03 TS0816-001 0.6 - 14	
Protocol Item	Test	Test condition Operative range Specifications	Test values	Permissible Tolerance Limiting values	Test result Remarks		
		- IEC 60947-5-1	Short-time capacity make and carry 30 A for 0.2 s ON 15 s OFF number of operations ≥ 2000 Short-time current across closed contact 250 A for 30 ms 3 operations with an interval of 10 s		No damage: The observed equipment had operated according to design requirements after test. No damage: The observed equipment had operated according to design requirements after test.		

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		Summary		03 2016-08-03 TS0816-001 0.6 - 19	
Protocol Item	Test	Test condition Operative range Specifications	Test values	Permissible Tolerance Limiting values	Test result Remarks
3.1.5	Damp heat, cyclic (17h/28hour cycle)	- IEC 60068-2-30 - IECEN 60068-2-30 Test Db	lower test temperature: 25 °C ± 3 °C relative humidity: 97 % ± 2 %, ± 3 % upper test temperature: 55 °C ± 2 °C relative humidity: 59 % ± 3 % temperature change: max 3) (6) 17 (K/min) test duration: 1 = 6 d (6 cycles each 24 h)	No damage The observed equipment had operated according to design requirements after test.	tested by: RST Rail System Testing GmbH 16761 Hennigsdorf (Germany) See Report No. P50-15-0181 See Report No. P50-15-0278 See Report No. P50-15-0239 No damage The observed equipment had operated according to design requirements after test. No damage The equipment was seen to operate according to design requirements after test.
3.2	Temperature and climatic stress during storage and transport	- IEC 60025-1 - IECEN 60025-27 - VDE 0435-327 tests according IEC 60068	3 = -40 °C 1 = 86 h 3 = +70 °C 1 = 86 h		
3.2.1	Cold	- IECEN 60068-2-1 Test Ad			
3.2.2	Dry heat	- IECEN 60068-2-2 Test Bd			

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		Summary		03 2016-08-03 TS0816-001 0.6 - 17	
Protocol Item	Test	Test condition Operative range Specifications	Test values	Permissible Tolerance Limiting values	Test result Remarks
3	Environmental tests	- IEC 60025-1 - IECEN 60025-27 - VDE 0435-327			tested by: RST Rail System Testing GmbH 16761 Hennigsdorf (Germany) See Report No. P50-15-0181 See Report No. P50-15-0278 See Report No. P50-15-0239
3.1	Temperature and climatic stress during operation	tests according IEC 60068 and IEC 60255-1	Due to the fact a look up of the device from -40 °C is not possible (the crypto processor heats the unit up phase because of its internal security) it is only possible to decrease the ambient temperature to -40 °C after the boot up phase. It is also not possible to switch off and switch on the device during the test at an ambient temperature of 85 °C. The crypto processor prevents again the boot up of the device because its internal chip temperature exceeds the specified temperature range of 55 °C.		

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		Summary		03 2016-08-03 TS0816-001 0.6 - 20	
Protocol Item	Test	Test condition Operative range Specifications	Test values	Permissible Tolerance Limiting values	Test result Remarks
3.2.3	Fast temperature change	- IECEN 60068-2-14 Profiling Test Nb	Tmin = -25 °C Tmax = +70 °C Tmax - Tmin = 2 h Temp.: 10 s 50 cycles		tested by: ALCOTEAM GmbH, 10407 Berlin The observed equipment had operated according to design requirements after test.
3.3	Industrial atmosphere	Device not in operation	Concentration, selected acc. to: - DIN 40046 V 736 (Test K0) 25 ppm SO2; 1 = 10 d - DIN 40046 V 737 (Test K1) 10 ppm - 15 ppm H2S; 1 = 10 d		tested by: ALCOTEAM GmbH, 10407 Berlin Report no.: PB7827.0110 The equipment was seen to operate according to design requirements
3.3.1	Gas test, oxidative	- IECEN 60068-2-42 Test Kc			Report no.: PB7827.0210 The equipment was seen to operate according to design requirements
3.3.2	Mixed gas test	- IECEN 60068-2-40, Method 4			
3.4	Mechanical Dynamic stress tests	Tests were carried out on devices in housings for panel flush mounting and surface mounting 1/6 up to 1/1 of 19 inch			tested by: ALCOTEAM GmbH, 10407 Berlin RST Rail System Testing GmbH 16761 Hennigsdorf

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		Summary		03 2016-08-03 TS0816-001 0.6 - 18	
Protocol Item	Test	Test condition Operative range Specifications	Test values	Permissible Tolerance Limiting values	Test result Remarks
3.1.1	Cold	- IECEN 60068-2-1 Test Ad	Device start up at: 3 = -25 °C and hold temperature for 1 = 86 h Temperature decreased during operation to 3 = -40 °C for 1 = 18 h		No damage The observed equipment had operated according to design requirements after test.
3.1.2	Dry heat	- IECEN 60068-2-1 Test Ad - IECEN 60068-2-2 Test Bd	3 = +70 °C 1 = 86 h 3 = +85 °C 1 = 18 h		No damage The observed equipment had operated according to design requirements after test.
3.1.3	Slow temperature change	- IECEN 60068-2-14 Test Nb	3 min = -25 °C 3 max = +75 °C 3 min = 10 h to 14 h Temp = 20 K/h > 5 cycles		No damage The observed equipment had operated according to design requirements after test.
3.1.4	Damp heat; steady state	- IECEN 60068-2-78, Test Cab	3 = +40 °C Test duration 1 = 86 days		No damage The observed equipment had operated according to design requirements after test.

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Energy Management Division Digital Grid		Summary		Summary	
Preced item	Test	Test condition Operative range Specifications	Test values	Permissive Tolerance Limiting values	Test result Remarks
3.4.3	Shock stress; stationary use	- IECEN 60068-2-27 Test Ea - IECEN 60255-21-3 Class 2	Frequency range: - 3 Hz to 35 Hz Stress level: - sinusoidal - 3 Hz to 8 Hz 5.6 mm 4.4 mm amplitude vertical axis - 8 mm 20 m/s ² acceleration horizontal axis - 10 m/s ² acceleration vertical axis - 1 octave/minute - 1 cycle in the three main axes of device		The observed equipment had operated according to design requirements during and after test. a) For technical reasons the frequency range has been raised at the lower frequency from 1 Hz to 3 Hz
3.4.4	Shock response test; stationary use	- IECEN 60068-2-27 Test Ea - IECEN 60255-21-2 Class 1	3 shocks at a time per main axis and direction 50 m/s ² , 11 ms half sinusoidal		The observed equipment had operated according to design requirements during and after test.
3.4.5	Shock withstand test; transport stress	- IECEN 60068-2-27 Test Eb - IECEN 60255-21-2 Class 1	3 shocks at a time per main axis and direction 150 m/s ² , 11 ms half sinusoidal		The observed equipment had operated according to design requirements after test.

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Energy Management Division Digital Grid		Summary		Summary	
Preced item	Test	Test condition Operative range Specifications	Test values	Permissive Tolerance Limiting values	Test result Remarks
3.4.1	Vibration response test, sinusoidal; stationary use	- IECEN 60068-2-6 Test Fc - IECEN 60255-21-1 Class 2	Frequency range: - 10 Hz to 150 Hz Stress level: - 10 Hz to 50 Hz; ± 0.075 mm amplitude 50 Hz to 150 Hz; 10 m/s ² acceleration - 1 octave/minute Test time: - 20 cycles in the three main axes of device		The observed equipment had operated according to design requirements during and after test.

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Energy Management Division Digital Grid		Summary		Summary	
Preced item	Test	Test condition Operative range Specifications	Test values	Permissive Tolerance Limiting values	Test result Remarks
3.4.6	Bump test (continuous shock); transport stress	- IECEN 60068-2-27 Test Eb - IECEN 60255-21-2 Class 1	1000 shocks at a time per main axis and direction 100 m/s ² , 16 ms half sinusoidal		The observed equipment had operated according to design requirements after test.

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Energy Management Division Digital Grid		Summary		Summary	
Preced item	Test	Test condition Operative range Specifications	Test values	Permissive Tolerance Limiting values	Test result Remarks
3.4.2	Vibration endurance test, sinusoidal; transport stress	- IECEN 60068-2-6 Test Fc - IECEN 60255-21-1 Class 2 ^{a)}	Frequency range: - 5 Hz to 150 Hz Stress level: - 5 Hz to 8 Hz; ± 7.5 mm amplitude - 8 Hz to 150 Hz; 20 m/s ² acceleration - 1 octave/minute Test time: - 20 cycles in the three main axes of device		The observed equipment had operated according to design requirements during and after test. a) The non-modular devices in the surface mounting frame meets only class 1.



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Protocol Item	Test	Test condition Operative range Specifications	Test values	Permissive Tolerance Limiting values	Test result Remarks		
4.1.3.2	RF-field, amplitude modulated Spot frequency test (EE)	- IECEN 80255-24 - IECEN 80255-23 - IECEN 80255-22-3	80 MHz, 160 MHz, 360 MHz, 450 MHz, 800 MHz 20 V/m (rms, unmodulated) 80 % AM, 1 MHz, 1 s + 10 s 1850 MHz, 2150 MHz 10 V/m (Rückwert, unmodulated) (rms, unmodulated) 80 % AM, 1 MHz, 1 s + 10 s	criteron A	tested by - PRO EHV GmbH, 15344 Straubing - Eurofins Product Service GmbH, 15226 Reichmads No maloperation The observed equipment had operated according to design requirements.		
4.1.3.3	RF-field, amplitude modulated Frequency sweep test (EEB)	- IEEB SIE C37.90.2	80 MHz to 1 GHz 30 V/m (rms, unmodulated) 80 % AM, 1 kHz frequency sweep 1% dwell time 2 s each frequency step	criteron A	tested by - PRO EHV GmbH, 15344 Straubing - Eurofins Product Service GmbH, 15226 Reichmads No maloperation The observed equipment had operated according to design requirements.		
4.1.3.4	RF-field, amplitude modulated Spot frequency test (EEB)	- IEEB SIE C37.90.2	80 MHz, 160 MHz, 450 MHz, 900 MHz, 20 V/m (rms, unmodulated) 80 % AM, 1 MHz, 1 s + 10 s	criteron A	tested by - PRO EHV GmbH, 15344 Straubing - Eurofins Product Service GmbH, 15226 Reichmads No maloperation The observed equipment had operated according to design requirements.		
4.1.3.5	RF-field, pulse modulated Spot frequency test (EEB)	- IEEB SIE C37.90.2	500 MHz 30 V/m duty cycle 50 % repetition rate 200 Hz 1 s + 10 s	criteron A	tested by - PRO EHV GmbH, 15344 Straubing - Eurofins Product Service GmbH, 15226 Reichmads No maloperation The observed equipment had operated according to design requirements.		

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Protocol Item	Test	Test condition Operative range Specifications	Test values	Permissive Tolerance Limiting values	Test result Remarks		
4.1	Electromagnetic compatibility (EMC) Immunity tests	- IECEN 80255-26 - IECEN 80255-22 - IECEN 80255-25 - IECEN 80255-23 - IECEN 80255-24 - IECEN 80255-22-3 - IECEN 80255-22-4 - IECEN 80255-22-5	Devices in operation mode; Measuring quantities 5 % lower/higher than measured pickup values	Acceptance criteria acc. to IECEN 61000-62 (A, B, C) and IECEN 60255-26, table 23 According to the standards, shielded cables were used for the connecting clamp in common mode test only.	tested by - PRO EHV GmbH, 15344 Straubing - Eurofins Product Service GmbH, 15226 Reichmads No maloperation The observed equipment had operated according to design requirements.		
4.1.1	1 MHz burst disturbance test	- IECEN 80255-26 - IECEN 80255-22 - IECEN 80255-23	Amplitude: - burst (peak value) - differential mode 2.5 kV (peak value) f = 1 MHz, Rf = 200 Ω repetition rate: 400 Hz test duration: 2 s	criteron B			

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Protocol Item	Test	Test condition Operative range Specifications	Test values	Permissive Tolerance Limiting values	Test result Remarks		
4.1.3.8	RF-field, pulse modulated Keying test (EEB)	- IEEB SIE C37.90.2	80 MHz to 1 GHz 35 V/m duty cycle 50 % repetition rate 1 Hz frequency step 1 % dwell time 2 s each frequency step	criteron A	tested by - PRO EHV GmbH, 15344 Straubing - Eurofins Product Service GmbH, 15226 Reichmads No maloperation The observed equipment had operated according to design requirements.		
4.1.4	Electrical test transient disturbances test (EFT)	- IECEN 80255-28 - IECEN 80255-22-4 - IECEN 80255-22-3 common and differential mode	amplitude: repetition frequency - power supply 4 kV, 5 Hz, unidirectional 2.5 MHz - all other inputs and outputs 4 kV, 5 MHz - earth 4 kV, 5 MHz new steps 5 m/50 m burst length 15 ms burst period 300 ms duration 5.5 min (tested at secondary selected circuit) both polarities	criteron B	tested by - PRO EHV GmbH, 15344 Straubing - Eurofins Product Service GmbH, 15226 Reichmads No maloperation The observed equipment had operated according to design requirements.		

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Protocol Item	Test	Test condition Operative range Specifications	Test values	Permissive Tolerance Limiting values	Test result Remarks		
4.1.2	Electrostatic discharge (ESD) test	- IECEN 80255-28 - IECEN 80255-22-3	contact discharge modular devices - front: 2 kV, 4 kV, 6 kV, 8 kV - rear: 2 kV, 4 kV, 6 kV, 8 kV contact discharge non-modular devices - front: 2 kV, 4 kV, 6 kV, 8 kV - rear: 2 kV, 4 kV, 6 kV air discharge modular and non- modular devices 2 kV, 4 kV, 6 kV, 8 kV, 12 kV, 15 kV both polarities C = 150 pF, Rf = 330 Ω	criteron B	tested by - PRO EHV GmbH, 15344 Straubing - Eurofins Product Service GmbH, 15226 Reichmads No maloperation The observed equipment had operated according to design requirements.		
4.1.3	Radiated electromagnetic field disturbance test	- IECEN 80255-26 - IECEN 80255-22-3	80 MHz to 1 GHz, 20 V/m (rms, unmodulated) 80 % AM, 1 kHz 1 GHz to 2.7 GHz, 10 V/m (rms, unmodulated) 80 % AM, 1 kHz frequency steps 1% dwell time 2 s each frequency step	criteron A	tested by - PRO EHV GmbH, 15344 Straubing - Eurofins Product Service GmbH, 15226 Reichmads No maloperation The observed equipment had operated according to design requirements.		

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Protocol Item	Test	Test condition Operative range Specifications	Test values	Permissible Tolerance Limiting values	Test result Remarks		
4.1.11	Pulsed magnetic field test	- IECEN 61000-4-9 wave shape B.4 μs/16 μs 5 positive and 5 negative shots at intervals of 10 s	- 1800 A/m	crit. B	No misoperation The observed equipment had operated according to design requirements, no influence to measurements observed		
4.1.12	DC Ripple	- IEC 60255-25 - IEC 61000-4-17	V _{DC} = 0.8% _{pk} , 1.20% _{pk} V _{pk} = 1.5% of rated voltage (peak-to-peak) 9% to 15% of V _N f = 16.7 Hz, 50 Hz, 100 Hz, 300 Hz (% = 50 Hz)	- 15% of rated voltage at intervals of 1 min at intervals of 1 min at intervals of 1 min at intervals of 1 min	Tested by: - DNV GL - Energy - SEMA Laboratories, Arnhem - Eurasim Product Service GmbH, 15208 Reichemsweide Test passed, no misoperation		

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Protocol Item	Test	Test condition Operative range Specifications	Test values	Permissible Tolerance Limiting values	Test result Remarks		
4.1.5	Surge immunity test	- IECEN 60255-26 - IECEN 61000-4-5 - IECEN 60255-22-9) wave shape 1, 2, μs/50 μs 5 positive and 5 negative shots at intervals of 1 min	power supply - common mode 4 kV; 12 Ω; 9 μF - differential mode 1 kV; 2 Ω; 19 μF - common mode 4 kV; 42 Ω; 0.5 μF - differential mode 2 kV; 42 Ω; 0.5 μF Amplitude: - common mode 4 kV (peak value) - differential mode 2.5 kV (peak value) f = 1 MHz, τ = 15 ms, R _L = 200 Ω repetition frequency 400 Hz duration: ≥ 80 s	crit. B	tested by: - PRO EMV GmbH, 15344 Straubing Germany - Eurasim Product Service GmbH, 15208 Reichemsweide No misoperation The observed equipment had operated according to design requirements.		
4.1.6	Oscillatory Surge Withstand Capability Test (REEF)	- IEEE Std C37.90.1	common and differential mode 4 kV surge, 5 ms/20 ns R _L = 50 Ω burst length: 15 ms burst period: 300 ms duration: ≥ 1 min both polarities	crit. B	No misoperation The observed equipment had operated according to design requirements.		
4.1.7	Fast Transient Surge Withstand Capability Test (REEF)	- IEEE Std C37.90.1	common and differential mode 4 kV surge, 5 ns/20 ns R _L = 50 Ω burst length: 15 ms burst period: 300 ms duration: ≥ 1 min both polarities	crit. B	No misoperation The observed equipment had operated according to design requirements.		

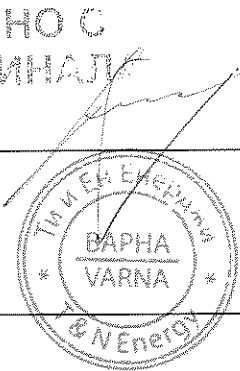
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Protocol Item	Test	Test condition Operative range Specifications	Test values	Permissible Tolerance Limiting values	Test result Remarks		
4.1.13	Damped oscillatory wave test	- IECEN 61000-4-19	common and differential mode 2.5 kV (peak value) both polarities 100 MHz test duration each R _L = 200 Ω common and differential mode 2.5 kV (peak value) both polarities 1 MHz test duration each R _L = 200 Ω common mode/peak 2 kV (peak value) both polarities 9 MHz, 10 MHz, 30 MHz test duration each R _L = 50 Ω	crit. B	tested by: - PRO EMV GmbH, 15344 Straubing Eurasim Product Service GmbH, 15208 Reichemsweide No misoperation The observed equipment had operated according to design requirements.		

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Protocol Item	Test	Test condition Operative range Specifications	Test values	Permissible Tolerance Limiting values	Test result Remarks		
4.1.8	Conducted disturbances induced by radio frequency fields, amplitude modulated frequency sweep test	- IECEN 60255-26 - IECEN 61000-4-6 - IECEN 60255-22-9)	150 MHz to 30 MHz 10 V (rms, unmodulated) 90% AM, 1 kHz; R _L = 100 Ω test duration: 1% peak time: 2 s sweep frequency stop	crit. B	tested by: - PRO EMV GmbH, 15344 Straubing Eurasim Product Service GmbH, 15208 Reichemsweide No misoperation The observed equipment had operated according to design requirements.		
4.1.9	Conducted disturbances induced by radio frequency fields, amplitude modulated Spot frequency test	- IECEN 60255-26 - IECEN 61000-4-6 - IECEN 60255-22-9)	27 MHz, 98 MHz 10 V (rms, unmodulated) 90% AM, 1 kHz; τ = 10 s	crit. A	tested by: - PRO EMV GmbH, 15344 Straubing Eurasim Product Service GmbH, 15208 Reichemsweide No misoperation The observed equipment had operated according to design requirements.		
4.1.10	Power frequency magnetic field test	- IECEN 60255-28 - IECEN 61000-4-8 - IECEN 60255-22-9)	- 30 A/m continuous; 50 Hz 300 A/m for 5 s; 50 Hz - 0.5 mT continuous; 50 Hz - 1000 A/m continuous; 50 Hz	crit. A	tested by: - PRO EMV GmbH, 15344 Straubing Eurasim Product Service GmbH, 15208 Reichemsweide No misoperation The observed equipment had operated according to design requirements. - Deviation of measured values U and I δ < 5%		

Protocol Item	Test	Test condition Operative range Specifications	Test values	Permissive Tolerance Limiting values	Test result Remarks
4.2	Emission (Radio frequency interference, RFI)	- IEC EN 60255-26 - IEC EN 50100-6-4 - IEC CISPR 11 - IEC CISPR 22 - EN 55011 - EN 55022	150 kHz to 30 MHz Test performed for device in life and max. operated condition 10 up to 11.19 inch device DC: V _{test} = 24 V DC: V _{ant} = 49 V DC: V _{em} = 60 V DC: V _{ref} = 220 V AC: V _{ant} = 230 V		tested by - PRO EMV GmbH, 15344 Strausberg - Eurasius Product Service GmbH, 15526 Reichenwalde Test successfully passed
4.2.1	Conducted emission at main port	- CISPR 11 - EN 55011 Group 1 / Class A	150 kHz to 30 MHz Test performed for device in life and max. operated condition		tested by - PRO EMV GmbH, 15344 Strausberg - Eurasius Product Service GmbH, 15526 Reichenwalde Test successfully passed, class A and B
4.2.2	Conducted emission at telecommunication port	- CISPR 22 - EN 55022 Group 1 / Class A	150 kHz to 30 MHz Test performed for device in life and max. operated condition		tested by - PRO EMV GmbH, 15344 Strausberg - Eurasius Product Service GmbH, 15526 Reichenwalde Test successfully passed, class A and B

Protocol Item	Test	Test condition Operative range Specifications	Test values	Permissive Tolerance Limiting values	Test result Remarks
4.1.14	Power frequency immunity test	- IEC EN 60255-26 - IEC EN 60255-27 (IEC EN 60255-27)	Compliance to IEC 60255-26 - Differential mode 150 V/50 Hz vs. 100 Ω and 0.1 μF - common mode 300 V/50 Hz vs. 200 Ω and 0.47 μF binary input common voltage 24 V 48 V 60 V 120 V 250 V	calculation A	External parallel resistor: 3.9 kOhm/min. 4 W 3.9 kOhm/min. 4 W 3.9 kOhm/min. 4 W 20 kOhm/min. 4 W 47 kOhm/min. 4 W Tested by - PRO EMV GmbH, 15344 Strausberg - Eurasius Product Service GmbH, 15526 Reichenwalde Test passed, no misoperation The observed equipment had operated according to design requirements.
4.1.15	Up and down sampling of auxiliary supply voltage	- IEC 60255-26 - IEC 60255-28 - VDE 0435-300	DC: V _{in} = 24 V DC: V _{in} = 60 V 0 V ≤ V _{in} ≤ V _{in} in 60 s 100 % V _{in} → 0 V in 60 s		tested by - PRO EMV GmbH, 15344 Strausberg - Eurasius Product Service GmbH, 15526 Reichenwalde The equipment had operated according to design requirements.
4.1.16	Voltage dips	- IEC 60255-26 - IEC 61000-4-11 (dc voltages) - IEC 61000-4-29 (dc voltages)	40 % residual voltage, corresponds to 60 % voltage dip 70 % residual voltage, corresponds to 30 % voltage dip	for 200 ms according IEC 60255-26 for 500 ms according IEC 60255-26	tested by - PRO EMV GmbH, 15344 Strausberg - Eurasius Product Service GmbH, 15526 Reichenwalde The equipment had operated according to design requirements.
4.1.17	Short interruptions	- IEC 60255-26 - IEC 61000-4-11 (dc voltages) - IEC 61000-4-29 (dc voltages)			tested by - PRO EMV GmbH, 15344 Strausberg - Eurasius Product Service GmbH, 15526 Reichenwalde The equipment had operated according to design requirements.

Protocol Item	Test	Test condition Operative range Specifications	Test values	Permissive Tolerance Limiting values	Test result Remarks
4.2.3	Shielded Emission (30 - 1000 MHz)	- CISPR 11 - EN 55011 Group 1 / Class A	Measuring distance 3 m Test performed for device in life and max. operated condition 10 up to 11.19 inch device		tested by - PRO EMV GmbH, 15344 Strausberg - Eurasius Product Service GmbH, 15526 Reichenwalde Test passed
4.2.4	Shielded Emission (1 - 6 GHz)	- CISPR 22 - EN 55022 Group 1 / Class A	Measuring distance 3 m Test performed for device in life and max. operated condition 10 up to 11.19 inch device		tested by - PRO EMV GmbH, 15344 Strausberg - Eurasius Product Service GmbH, 15526 Reichenwalde Test passed



Protocol Item	Test	Test condition Operative range Specifications	Test values	Permissive Tolerance Limiting values	Test result Remarks
		modular devices V _{in} = DC: 24V, 48V V _{in} = DC: 50 V, 110 V, 125V, 220 V, 250V and AC: 100 V, 115 V, 220 V	DC: V = 24 V DC: V = 48 V DC: V = 60 V DC: V = 110 V DC: V = 125 V DC: V = 230 V DC: V = 250 V AC: V = 100 V AC: V = 115 V AC: V = 230 V at speed 50°/180°/270°	to min. 50 ms to min. 50 ms to min. 50 ms to min. 50 ms to min. 50 ms to min. 50 ms to min. 50 ms to min. 50 ms to min. 50 ms to min. 50 ms to min. 50 ms to min. 50 ms to min. 50 ms	50 % of output relays energised, 2 communication modules activated to min. 50 ms to min. 50 ms to min. 50 ms to min. 50 ms to min. 50 ms to min. 50 ms to min. 50 ms to min. 50 ms to min. 50 ms to min. 50 ms to min. 50 ms to min. 50 ms to min. 50 ms
		Non-modular devices V _{in} = DC: 24V, 48V V _{in} = DC: 60 V, 110 V, 125V and DC: 110 V, 125V, 220 V, 250V AC: V = 115 V AC: V = 230 V at speed 50°/180°/270°	DC: V = 24 V DC: V = 48 V DC: V = 60 V DC: V = 110 V DC: V = 125 V DC: V = 230 V AC: V = 115 V AC: V = 230 V at speed 50°/180°/270°	min. 30 ms min. 50 ms min. 200 ms min. 200 ms min. 200 ms min. 200 ms min. 200 ms min. 200 ms min. 200 ms min. 200 ms min. 200 ms min. 200 ms min. 200 ms	50 % of output relays energised, 2 communication modules activated min. 30 ms min. 50 ms min. 200 ms min. 200 ms min. 200 ms min. 200 ms min. 200 ms min. 200 ms min. 200 ms min. 200 ms min. 200 ms min. 200 ms

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Protocol Item	Test	Test values	Test values	Permissible Tolerances Limiting values	Test result Remarks		
5	Approvals UL/CSA certification	UL 508, CSA C22.2 No. 14-13 Safety for Industrial Control Equipment		UL File Number: E194618 Protective Relays	The devices are in compliance with U.S. and Canadian requirements with the values as stated in technical data.		
					Report Reference for modular devices: File E194616, volume 1, section 16		
					Report Reference for non-modular devices: File E194618, volume 1, section 22		

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Appendix A1 : List of used standards																																																																																																							
A1-1																																																																																																							
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IEC 60068-2-43	2003	Environmental testing – Part 2-43: Tests; Test Kd: Hydrogen sulphide test for contacts and connections					
IEC 60068-2-60	2015	Environmental testing – Part 2: Tests – Test Ke: Flowing mixed gas corrosion test					
IEC 60068-2-78	2012	Environmental testing – Part 2-78: Tests – Test Ca; Damp heat, steady state					
IEC 60068-3-3	1991	Environmental testing, part 3: guidance; seismic test methods for equipments					
(IEC 60255-5)	replaced by IEC 60255-27	Electrical Relays – Part 5: Installation coordination for measuring relays and protection equipment – Requirements and tests					
(IEC 60255-11)	replaced by IEC 60255-28	Measuring relays and protection equipment – Part 11: Voltage dips, short interruptions, variations and dips on auxiliary power supply port					
IEC 60255-21-1	1988	Electrical relays; part 21: vibration, shock, bump and seismic tests on measuring relays and protection equipment; section one: vibration tests (sinusoidal)					
IEC 60255-21-2	1988	Electrical relays; part 21: vibration, shock, bump and seismic tests on measuring relays and protection equipment; section two: shock and bump tests					
IEC 60255-21-3	1993	Electrical relays; part 21: vibration, shock, bump and seismic tests on measuring relays and protection equipment; section 3: seismic tests					
(IEC 60255-22-1)	replaced by IEC 60255-28	Electrical disturbance tests – 1 MHz burst immunity tests					
(IEC 60255-22-2)	replaced by IEC 60255-28	Electrical disturbance tests – Electrostatic discharge tests					
(IEC 60255-22-3)	replaced by IEC 60255-28	Electrical disturbance tests – Radiated electromagnetic field immunity					
(IEC 60255-22-4)	replaced by IEC 60255-28	Electrical disturbance tests – Electrical fast transient/burst immunity test					
(IEC 60255-22-5)	replaced by IEC 60255-28	Electrical disturbance tests – Surge immunity test					
(IEC 60255-22-6)	replaced by IEC 60255-28	Immunity to conducted disturbances induced by radio frequency fields					
(IEC 60255-22-7)	replaced by IEC 60255-28	Electrical relays – Part 22-7: Electrical disturbance tests for measuring relays and protection equipment – Power frequency immunity tests					
(IEC 60255-28)	replaced by IEC 60255-28	Electromagnetic emission tests for measuring relays and protection equipment					
IEC 60255-28	2013	Measuring relays and protection equipment – Part 28: Electromagnetic compatibility requirements (with reference to IEC 61000 and CISPR)					
IEC 60255-27	2013	Measuring relays and protection equipment – Part 27: Product safety requirements					
IEC 60529	2013	Degrees of protection provided by enclosures (IP code)					
IEC 60847-5-1	2009	Low-voltage switchgear and controlgear – Part 5-1: Control circuit devices and switching elements – Electro-mechanical control circuit devices					
IEC 61131-2	2007	Programmable controllers – Part 2: Equipment requirements and tests					
IEC 61140	2009	Protection against electric shock – Common aspects for installation and equipment					
IEC 61810-1	2015	Electromechanical elementary relays – Part 1: General requirements					
IEC 61000-4-2	2000	Electromagnetic compatibility (EMC) – Part 4-2: Testing and measurement techniques – Electrostatic discharge immunity test					
IEC 61000-4-3	2010	Electromagnetic compatibility (EMC) – Part 4-3: Testing and measurement techniques – Radiated, radio-frequency, electromagnetic field immunity test					
IEC 61000-4-4	2012	Electromagnetic compatibility (EMC) – Part 4-4: Testing and measurement techniques – Electrical fast transients immunity test					
IEC 61000-4-5	2014	Electromagnetic compatibility (EMC) – Part 4-5: Testing and measurement techniques – Surge immunity test					
IEC 61000-4-6	2013	Electromagnetic compatibility (EMC) – Part 4-6: Testing and measurement techniques – Immunity to conducted disturbances, induced by radio-frequency fields					
IEC 61000-4-6	2009	Electromagnetic compatibility (EMC) – Part 4-6: Testing and measurement techniques – Power frequency magnetic field immunity test					
IEC 61000-4-9	2001	Electromagnetic compatibility (EMC) – Part 4-9: Testing and measurement techniques – Pulse magnetic field immunity test					

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IEC 61000-4-11	2004	Electromagnetic compatibility (EMC) – Part 4-11: Testing and measurement techniques – Voltage dips, short interruptions and voltage variations immunity tests					
IEC 61000-4-16	2011	Electromagnetic compatibility (EMC) – Part 4-16: Testing and measurement techniques – Test for immunity to conducted, common mode disturbances in the frequency range 0 Hz to 150 kHz					
IEC 61000-4-17	2009	Electromagnetic compatibility (EMC) – Part 4-17: Testing and measurement techniques – Ripple on d.c. input power port immunity test					
IEC 61000-4-18	2011	Electromagnetic compatibility (EMC) – Part 4-18: Testing and measurement techniques – Immunity to oscillatory wave immunity test					
IEC 61000-4-29	2000	Electromagnetic compatibility (EMC) – Part 4-29: Testing and measurement techniques – Voltage dips, short interruptions and voltage variations on d.c. input power port immunity tests					
CISPR 11	2015	Industrial, scientific and medical equipment – Radio-frequency disturbance characteristics – Limits and methods of measurement					
CISPR 22	2008	Information technology equipment – Radio disturbance characteristics – Limits and methods of measurement					
German standards							
Date of issue							
VDE 0435-301	2015	Elektronencharakteristische Elementarrelais – Teil 201: Allgemeine Anforderungen Corresponds to IEC 61810-1					
VDE 0435-300	2010	Messrelais und Schutzrelais – Teil 300: Allgemeine Anforderungen Corresponds to IEC 60255-1					
VDE 0435-320	2014	Messrelais und Schutzrelais – Teil 320: Anforderungen an die elektromagnetische Verträglichkeit Corresponds to IEC 60255-26					
VDE 0435-327	2014	Messrelais und Schutzrelais – Teil 327: Anforderungen an die Produkticherheit Corresponds to IEC 60255-27					

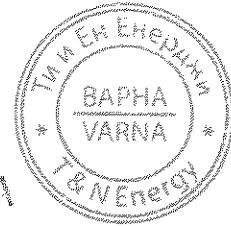
ВЪРНО С
ОРИГИНАЛА

Summary

1.20	49 Thermal Overload Protection 1-phase
1.20.1	Specifications
-	VDE 0435
-	IEC/EN 60255-1, Item 7, Annex A, B
Test condition/Test values:	calculation method = OIL-calcul - Modus I _{thmax} = I _{thmax} - Modus I _{thmax} = I _{thmax}
Permissible tolerance/Limiting values:	k = Factor according to IEC 60255-8 or VDE 0435 T3011
1.20.7	Pickup threshold k * I_N
Test condition:	k = I _{thmax} /I _{rated} 0.10 ≤ k ≤ 4.00
Test values:	k = 0.10, 1.00, 4.00
Permissible tolerance/Limiting values:	k ≤ 2% or 10mA at I _{rated} = 1A k ≤ 2% or 50mA at I _{rated} = 5A class 2% acc. to IEC 255-8
Test results/Remarks:	k ≤ 2%
1.20.3	Thermal time constant
Test condition:	30s ≤ t _{th} ≤ 60000s
Test values:	t _{th} = 30s, 100s, 60000s
Test results/Remarks:	function correct
1.20.4	Thermal warning stage
Test condition:	⇒ warm → trip 50% ≤ P _{warm} ≤ 100%
Test values:	⇒ warm = 60%, 70%, 80%, 100%
Test results/Remarks:	function correct
1.20.5	Current warning stage
Test condition:	0.03 I _{rated} ≤ I _{warm} ≤ 35.00 I _{rated}
Test values:	I _{warm} = 0.03A, 0.5A, 5A, 10A
Test results/Remarks:	function correct
1.20.6	Maximum thermal current
Test condition:	0.03 I _{rated} ≤ I _{max thermal} ≤ 10.00 I _{rated}
Test values:	I _{max thermal} = 1.1A, 2.5A, 10A

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ВЯРНО С
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Summary

Test results/Remarks:	function correct
1.20.7	Dropout ratio
Test condition:	dropout threshold operate ratio 50% ≤ r ≤ 95%
Test values:	r = 50%, 70%, 90%, 95%
Test results/Remarks:	function correct
1.20.8	Tripping time characteristics
Test condition:	k = I _{thmax} /I _{rated} (RRC 255-8) 0.10 ≤ k ≤ 4.00 τ = Time constant 30 s ≤ τ ≤ 60000 s with and without preload
Test values:	tripping times t Fault L-N, Modus I _{thmax} k = 0.1, 1, 4; τ = 100s k = 1; τ = 30s, 100s, 60000s
Permissible tolerance/Limiting values:	k ≤ 3 % or 1s class 3 % acc. to IEC 255-8 for I _{thmax} /I _{rated} > 1.25 t = τ * k [(I _{thmax} /I _{rated}) ^α (I _{pick} /I _{rated}) ^β] / (I _{thmax} /I _{rated}) ^γ for I _{thmax} /I _{rated} ≤ 8
Test results/Remarks:	function correct k ≤ 2% or 0.2s

Summary

1.21	48 Unbalanced-Load Protection
1.21.1	Specifications
-	VDE 0435
-	IEC/EN 60255-1, Item 7, Annex A, B
-	IEC/EN 60255-151
1.21.2	Thermal characteristics
1.21.3	Max. continuously perm. I ₂
Test condition:	3 % ≤ I ₂ ≤ 30 %
Test values:	3 % ≤ I ₂ ≤ 30 %
Permissible tolerance/Limiting values:	I ₂ ≤ 3 % of setting value or 3 mA at I _{rated} = 1 A or 15 mA at I _{rated} = 5 A
Test results/Remarks:	I ₂ ≤ 3 % of setting value or 3 mA at I _{rated} = 1 A or 15 mA at I _{rated} = 5 A
1.21.4	Unbalanced load factor K
Test condition:	1.0 s ≤ K ≤ 109.0 s
Test values:	various settings
Test results/Remarks:	function correct
1.21.6	Cooling time thermal replica TCool_{min}
Test condition:	0 s ≤ TCool _{min} ≤ 50000 s
Test values:	various settings
Test results/Remarks:	function correct
1.21.8	Time delays
Test condition:	added to the inherent operating times
Test values:	0.00 s ≤ T _d ≤ 60.00 s or ∞
Permissible tolerance/Limiting values:	T _d ≤ 1 % of setting value or 10 ms
Test results/Remarks:	T _d ≤ 1 % or 10 ms

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Summary

1.22	60C Current Unbalance Protection for Capacitors 3-phase and 1-phase
1.22.1	Specifications
-	VDE 0435
-	IEC/EN 60255-1, Item 7, Annex A, B
-	IEC/EN 60255-151
1.22.2	Current Unbalance Protection, I ₂ stage
1.22.2.1	Pickup values
Test condition:	0.030 I _{rated} ≤ I ₂ ≤ 35.000 I _{rated}
Test values:	I _{rated} = 50 Hz, 60Hz; 0.030 I _{rated} ≤ 30I ₂ ≤ 35.000 I _{rated}
Permissible tolerance/Limiting values:	I ₂ ≤ 1 % of setting value or 0.005 I _{rated}
Test results/Remarks:	I ₂ ≤ 1 % of setting value or 0.005 I _{rated}
1.22.2.2	Dropout ratio
Test condition:	see Item 1.22.2.1
Test values:	see Item 1.22.2.1
Permissible tolerance/Limiting values:	0.85 or 15 mA (I _{rated} 1A, non-sensitive CT) or 75 mA (I _{rated} 5A, non-sensitive CT) or 0.8 mA (I _{rated} 1A, sensitive CT) or 2.5 mA (I _{rated} 5A, sensitive CT)
Test results/Remarks:	0.95 or 15 mA (I _{rated} 1A, non-sensitive CT) or 75 mA (I _{rated} 5A, non-sensitive CT) or 0.5 mA (I _{rated} 1A, sensitive CT) or 2.5 mA (I _{rated} 5A, sensitive CT)
Pickup times	
Test condition:	see Item 1.22.2.1
Test values:	I ₂ /I _{rated} = 1; I ₂ /I _{rated} = 2
Permissible tolerance/Limiting values:	t approx. 25 ms + OOT at 50 Hz 22 ms + OOT at 60 Hz
1.22.2.3	Test results/Remarks:
	1 25 ms + OOT at 50 Hz 20 ms + OOT at 60 Hz
Time delays	
Test condition:	added to the inherent operating times
Test values:	0.000 s ≤ T _d ≤ 60.000 s
Permissible tolerance/Limiting values:	T _d ≤ 1 % of setting value or 10 ms

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Summary

Test results/Remarks: R1 1 % of setting value or 10 ms

Summary

1.23 87V Voltage Differential Protection for Capacitors
1.23.1 Specifications

- VDE 0435
- IEC/EN 60255-1, Item 7, Annex A, B

1.23.2 Voltage differential 2-stage
1.23.2.1 Pickup values

Test condition: 0.005 p.u. threshold value, 1.000 p.u.
(secondary voltage threshold ≥ 0.2 V)

rated = 50 Hz, 60Hz

Permissive tolerance/Limiting values: 1 % of setting value or 0.05 V

Test results/Remarks: 1 % of setting value or 0.05 V

1.23.2.2 Dropout ratio

Test condition: see item 1.23.2.1

Test values: 95 % of Threshold value or 0.15 V or 50% of Threshold (for secondary voltage threshold : 0.3 V)

Permissive tolerance/Limiting values: 0.5 % of dropout value or 0.05 V

Test results/Remarks: 0.5 % of dropout value or 0.05 V

1.23.2.3 Pickup times

Test condition: see item 1.23.2.1

1.2" threshold

Permissive tolerance/Limiting values: 1 approx.
30 ms + OOT at frated = 50 Hz
27 ms + OOT at frated = 60 Hz

Test results/Remarks: 1 approx.
30 ms + OOT at frated = 50 Hz
27 ms + OOT at frated = 60 Hz

1.23.2.4 Dropout times

Test condition: see item 1.23.2.1

Permissive tolerance/Limiting values: 1 approx.
20 ms + OOT at frated = 50 Hz
18 ms + OOT at frated = 60 Hz

Test results/Remarks: 1 approx.
20 ms + OOT at frated = 50 Hz
18 ms + OOT at frated = 60 Hz

Summary

1.23.2.5 Operate delay

Test condition: see item 1.23.2.1

1.2" threshold

Test values: 0.00 s \leq T \leq 50.00 s

Permissive tolerance/Limiting values: - 1 % of setting value or 10 ms

Test results/Remarks: - 1 % of setting value or 10 ms

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Summary

1.24 87C Capacitor Bank Differential Protection
1.24.1 Specifications

- VDE 0435
- IEC/EN 60255-1, Item 7, Annex A, B

1.24.2 General test conditions

f_{nom} : 50 Hz, 60 Hz

I_{nom} : 1 A, 5 A

1.24.3 I-DIFF

1.24.3.1 Operate curve

1.24.3.1.1 I-DIFF Threshold

Test condition: 0.05 \times $I_{nom} \times t_{diff} \geq 2.00$

Permissive tolerance/Limiting values: $|t| \leq 2$ % of setting value

Test results/Remarks: $|t| < 2$ %

1.24.3.1.2 I-DIFF Slope 1

Test condition: 0.00 to 0.80

Test results/Remarks: confirmed

1.24.3.1.3 I-DIFF Intersection 1 test

Test condition: 0.00 \times $I_{nom} \times t_{diff} \geq 5.00$

Test results/Remarks: confirmed

1.24.3.1.4 I-DIFF Slope 2

Test condition: 0.25 to 0.65

Test results/Remarks: confirmed

1.24.3.1.5 I-DIFF Intersection 2 test

Test condition: 1.00 \times $I_{nom} \times t_{diff} \geq 20.00$

Test results/Remarks: confirmed

1.24.3.2 Starting detection

1.24.3.2.1 Threshold startup detection

Test condition: 0.1 \times $I_{nom} \times t_{diff} \geq 2.0$

Permissive tolerance/Limiting values: $|t| \leq 2$ % of setting value

Test results/Remarks: $|t| < 2$ %

Summary

1.24.3.2.2	Factor increasing char.	Test condition: 1.0 to 5.0 Test results/Remarks: confirmed
1.24.3.2.3	Max. perm. Start time	Test condition: $0.1 s \leq T_s \leq 180.0 s$ Permissive tolerance/limiting values: $ N \leq 1\%$ of setting value or 10 ms Test results/Remarks: $ N \leq 1\%$ of setting value or 10 ms
1.24.3.3	DC offset detection	
1.24.3.3.1	Factor increasing char. DC	Test condition: 1.0 to 5.0 Test results/Remarks: confirmed
1.24.3.4	Ext. fault detection	
1.24.3.4.1	Threshold of add-on stabiliz.	Test condition: $1.00 \geq I_{R_{lock}} \geq 20.00$ Permissive tolerance/limiting values: $ N \leq 2\%$ of setting value Test results/Remarks: $ N \leq 2\%$
1.24.3.4.2	Time of add-on stabiliz.	Test condition: $0.00 s \leq T_s \leq 5.00 s$ Permissive tolerance/limiting values: $ N \leq 1\%$ of setting value or 10 ms Test results/Remarks: $ N \leq 1\%$ of setting value or 10 ms
1.24.3.4.3	Cross-blk time of add-on stabiliz.	Test condition: $0.00 s \leq T_s \leq 2.00 s$ Permissive tolerance/limiting values: $ N \leq 1\%$ of setting value or 10 ms Test results/Remarks: $ N \leq 1\%$ of setting value or 10 ms
1.24.3.5	Dropout ratio	Test condition: see item 1.24.3.1.1 Permissive tolerance/limiting values: $r \leq 0.7$ Test results/Remarks: $r \leq 0.7$

Summary

1.24.3.6	Operating Times	Test condition: see item 1.24.3.1.1 Test values: $U_{DVT} = 1, U_{DVT} = 2$ Permissive tolerance/limiting values: t approx. 23 ms + OOT at 50 Hz 20 ms + OOT at 60 Hz Test results/Remarks: t approx. 23 ms + OOT at 50 Hz 20 ms + OOT at 60 Hz
1.24.3.7	Dropout times	Test condition: see item 1.24.3.1.1 Test values: see item 1.24.3.6 Permissive tolerance/limiting values: t approx. 23 ms + OOT at 50 Hz 20 ms + OOT at 60 Hz Test results/Remarks: t approx. 23 ms + OOT at 50 Hz 20 ms + OOT at 60 Hz
1.24.4	IDEFF test	
1.24.4.1	Threshold	Test condition: $0.5 \leq I_{R_{lock}} \leq 35.0$ Permissive tolerance/limiting values: $ N \geq 2\%$ of setting value Test results/Remarks: $ N \leq 2\%$
1.24.4.2	Dropout ratio	Test condition: see item 1.24.4.1 Permissive tolerance/limiting values: $r \leq 0.7$ Test results/Remarks: $r \leq 0.7$
1.24.4.3	Operating Times	Test condition: see item 1.24.4.1 Test values: $U_{DVT} = 1, U_{DVT} = 2$ Permissive tolerance/limiting values: t approx. 8 ms + OOT at 50 Hz 8 ms + OOT at 60 Hz Test results/Remarks: t approx. 8 ms + OOT at 50 Hz 8 ms + OOT at 60 Hz

Summary

1.24.4.4	Dropout times	Test condition: see item 1.24.4.1 Test values: see item 1.24.4.3 Permissive tolerance/limiting values: t approx. 23 ms + OOT at 50 Hz 20 ms + OOT at 60 Hz Test results/Remarks: t approx. 23 ms + OOT at 50 Hz 20 ms + OOT at 60 Hz
1.24.4.5	Time delays	Test condition: added to the inherent operating times Test values: $0.00 s \leq T_D \leq 80.00 s$ Permissive tolerance/limiting values: $ N \leq 1\%$ of setting value or 10 ms Test results/Remarks: $ N \leq 1\%$ of setting value or 10 ms
1.24.5	Frequency Operating Range	Frequency manual update: 10 Hz to 80 Hz Test results/Remarks: confirmed

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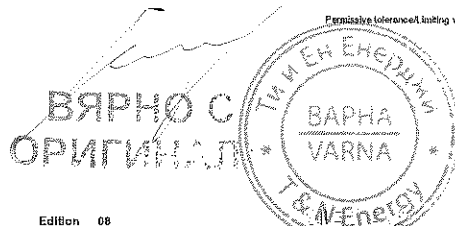
Summary

1.25	47/59 Overvoltage Protection	
1.25.1	Specifications	<ul style="list-style-type: none"> VDE 0435 IECEN 60255-1, Item 7, Annex A, B IECEN 60255-127
1.25.2	3ph Voltage ph-to-gnd, ph-to-ph V with definite time overvoltage stage	
1.25.2.1	Pickup values	Test condition: Fundamental components, RMS values $f_{nom} = 50 \text{ Hz}, 60 \text{ Hz}$ $0.900 \text{ V} \leq U_{th} \leq 340.000 \text{ V}$ Permissive tolerance/limiting values: in the range $f_{nom} \pm 10\%$ $ N \leq 0.5\%$ of setting value or 0.05 V Test results/Remarks: in the range $f_{nom} \pm 10\%$ $ N \leq 0.5\%$ of setting value or 0.05 V
1.25.2.2	Dropout ratio	Test condition: See item 1.25.2.1 Test values: $r =$ stable dropout ratio $0.50 \geq r \geq 0.99$ Permissive tolerance/limiting values: $ N \geq 0.5\%$ of dropout value or 0.05 V Test results/Remarks: $ N \geq 0.5\%$ of dropout value or 0.05 V
1.25.2.3	Pickup times	Test condition: See item 1.25.2.1 1.2" threshold value Permissive tolerance/limiting values: t approx. 25 ms + OOT at $f_{nom} = 50 \text{ Hz}$ 22 ms + OOT at $f_{nom} = 60 \text{ Hz}$ Test results/Remarks: t approx. 25 ms + OOT at $f_{nom} = 50 \text{ Hz}$ 22 ms + OOT at $f_{nom} = 60 \text{ Hz}$
1.25.2.4	Dropout times	Test condition: See item 1.25.2.1 Permissive tolerance/limiting values: t approx. 20 ms + OOT Test results/Remarks: t approx. 20 ms + OOT
1.25.2.5	Time delays	Test condition: See item 1.25.2.1

Summary

Test values:	0.00 s ≤ T ≤ 60.00 s
Permissible tolerance/limiting values:	N ≤ 1 % of setting value or 10 ms
Test results/Remarks:	N ≤ 1 % of setting value or 10 ms
1.25.3 3ph Voltage ph-to-gnd, ph-to-ph V with inverse time overvoltage stage	
1.25.3.1 Pickup values	
Test condition:	Fundamental components, RMS values f _{nom} = 50 Hz, 60 Hz 0.300 V ≤ pickup value ≤ 340.000 V
Permissible tolerance/limiting values:	In the range f _{nom} ±10 % N ≤ 0.5 % of setting value or 0.05 V
Test results/Remarks:	In the range f _{nom} ±10 % N ≤ 0.5 % of setting value or 0.05 V
1.25.3.2 Dropout ratio	
Test condition:	See item 1.25.3.1
Permissible tolerance/limiting values:	N ≤ 0.5 % of setting value or 0.05 V
Test results/Remarks:	N ≤ 0.5 % of setting value or 0.05 V
1.25.3.3 Pickup times	
Test condition:	See item 1.25.3.1 1.2" pickup value
Permissible tolerance/limiting values:	Approx. 25 ms + OOT at f _{nom} = 50 Hz 22 ms + OOT at f _{nom} = 60 Hz
Test results/Remarks:	Approx. 25 ms + OOT at f _{nom} = 50 Hz 22 ms + OOT at f _{nom} = 60 Hz
1.25.3.4 Dropout times	
Test condition:	See item 1.25.3.1 Reset time to exit 0 s
Permissible tolerance/limiting values:	Approx. 20 ms + OOT
Test results/Remarks:	Approx. 20 ms + OOT
1.25.3.6 Definite time delays	
Test condition:	See item 1.25.3.1
Test values:	0.00 s ≤ T ≤ 60.00 s
Permissible tolerance/limiting values:	N ≤ 1 % of setting value or 10 ms

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Summary

Test results/Remarks:	1 approx. 25 ms + OOT at f _{nom} = 50 Hz 22 ms + OOT at f _{nom} = 60 Hz
1.25.4.4 Dropout times	
Test condition:	See item 1.25.4.1
Permissible tolerance/limiting values:	1 approx. 20 ms + OOT
Test results/Remarks:	1 approx. 20 ms + OOT
1.25.4.5 Time delays	
Test condition:	See item 1.25.4.1
Test values:	0.00 s ≤ T ≤ 60.00 s
Permissible tolerance/limiting values:	N ≤ 1 % of setting value or 10 ms
Test results/Remarks:	N ≤ 1 % of setting value or 10 ms
1.25.6 Zero Sequence, Residual Voltage V0	
1.25.6.1 Pickup values	
Test condition:	RMS values, fundamental components, fundamental components over 2 cycles 0.300 V ≤ threshold value ≤ 340.000 V
Permissible tolerance/limiting values:	In the range f _{nom} ±10 % N ≤ 0.5 % of setting value or 0.05 V
Test results/Remarks:	In the range f _{nom} ±10 % N ≤ 0.5 % of setting value or 0.05 V
1.25.6.2 Dropout ratio	
Test condition:	See item 1.25.6.1
Test values:	r = settable dropout ratio 0.60 ≤ r ≤ 0.80
Permissible tolerance/limiting values:	N ≤ 0.5 % of dropout value or 0.05 V
Test results/Remarks:	N ≤ 0.5 % of dropout value or 0.05 V
1.25.6.3 Pickup times (Filter = RMS value, Standard Filter)	
Test condition:	See item 1.25.6.1 1.2" threshold value
Permissible tolerance/limiting values:	1 approx. 25 ms + OOT at f _{nom} = 50 Hz 22 ms + OOT at f _{nom} = 60 Hz

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Summary

Test results/Remarks:	N ≤ 1 % of setting value or 10 ms
1.25.3.8 Reset time	
Test condition:	See item 1.25.3.1
Test values:	0.00 s ≤ T ≤ 60.00 s
Permissible tolerance/limiting values:	N ≤ 1 % of setting value or 10 ms
Test results/Remarks:	N ≤ 1 % of setting value or 10 ms
1.25.3.7 Inverse time characteristic	
Test condition:	See item 1.25.3.1
Permissible tolerance/limiting values:	Character constant k: 0.00 ≤ k ≤ 300.00 Characteristic constant α: 0.010 ≤ α ≤ 5.000 Characteristic constant c: 0.000 ≤ c ≤ 5.000 Time dial: 0.05 ≤ T _d ≤ 16.00
Test results/Remarks:	N ≤ 5 % of the setting value or 30 ms
1.25.4 Positive sequence V1	
1.25.4.1 Pickup values	
Test condition:	f _{nom} = 50 Hz, 60 Hz 0.300 V ≤ threshold value ≤ 340.000 V
Permissible tolerance/limiting values:	In the range f _{nom} ±10 % N ≤ 0.5 % of setting value or 0.05 V
Test results/Remarks:	In the range f _{nom} ±10 % N ≤ 0.5 % of setting value or 0.05 V
1.25.4.2 Dropout ratio	
Test condition:	See item 1.25.4.1
Test values:	r = settable dropout ratio 0.60 ≤ r ≤ 0.80
Permissible tolerance/limiting values:	N ≤ 0.5 % of dropout value or 0.05 V
Test results/Remarks:	N ≤ 0.5 % of dropout value or 0.05 V
1.25.4.3 Pickup times	
Test condition:	See item 1.25.4.1 1.2" threshold value
Permissible tolerance/limiting values:	1 approx. 25 ms + OOT at f _{nom} = 50 Hz 22 ms + OOT at f _{nom} = 60 Hz

Summary

Test results/Remarks:	1 approx. 25 ms + OOT at f _{nom} = 50 Hz 22 ms + OOT at f _{nom} = 60 Hz
1.25.6.4 Dropout times (Filter = RMS value, Standard Filter)	
Test condition:	See item 1.25.6.1
Permissible tolerance/limiting values:	1 approx. 20 ms + OOT at f _{nom} = 60 Hz 18.6 ms + OOT at f _{nom} = 60 Hz
Test results/Remarks:	1 approx. 20 ms + OOT at f _{nom} = 60 Hz 18.6 ms + OOT at f _{nom} = 60 Hz
1.25.6.5 Pickup times (Filter = over 2 cycles)	
Test condition:	See item 1.25.6.1 1.2" threshold value
Permissible tolerance/limiting values:	1 approx. 45 ms + OOT at f _{nom} = 50 Hz 38 ms + OOT at f _{nom} = 60 Hz
Test results/Remarks:	1 approx. 45 ms + OOT at f _{nom} = 50 Hz 38 ms + OOT at f _{nom} = 60 Hz
1.25.6.6 Dropout times (Filter = over 2 cycles)	
Test condition:	See item 1.25.6.1
Permissible tolerance/limiting values:	1 approx. 31.00 ms + OOT at f _{nom} = 50 Hz 27.00 ms + OOT at f _{nom} = 60 Hz
Test results/Remarks:	1 approx. 31.00 ms + OOT at f _{nom} = 50 Hz 27.00 ms + OOT at f _{nom} = 60 Hz
1.25.6.7 Time delays	
Test condition:	See item 1.25.6.1
Test values:	0.00 s ≤ T ≤ 60.00 s
Permissible tolerance/limiting values:	N ≤ 1 % of setting value or 10 ms
Test results/Remarks:	N ≤ 1 % of setting value or 10 ms
1.25.8 Any Voltage Vx	
1.25.8.1 Pickup values	
Test condition:	Fundamental components, RMS values f _{nom} = 50 Hz, 60 Hz

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Summary

0.300 V₀ threshold value \geq 340.000 V

Permissive tolerance/Limiting values:
In the range $f_{ovd} \pm 10\%$
 $|N| \leq 0.5\%$ of setting value or 0.05 V

Test results/Remarks:
In the range $f_{ovd} \pm 10\%$
 $|N| \leq 0.5\%$ of setting value or 0.05 V

1.25.8.2 Dropout ratio

Test condition: See item 1.25.8.1

Test values: $r =$ settable dropout ratio
0.00 $\leq r <$ 0.09

Permissive tolerance/Limiting values:
 $|N| \leq 0.5\%$ of setting value or 0.05 V

Test results/Remarks:
 $|N| \leq 0.5\%$ of setting value or 0.05 V

1.25.8.3 Pickup times

Test condition: See item 1.25.8.1
1.2" threshold value

Permissive tolerance/Limiting values:
1 approx.
25 ms + OOT at $f_{ovd} = 50$ Hz
22 ms + OOT at $f_{ovd} = 60$ Hz

Test results/Remarks:
1 approx.
25 ms + OOT at $f_{ovd} = 50$ Hz
22 ms + OOT at $f_{ovd} = 60$ Hz

1.25.8.4 Dropout times

Test condition: See item 1.25.8.1

Permissive tolerance/Limiting values:
1 approx.
20 ms + OOT

Test results/Remarks:
1 approx.
20 ms + OOT

1.25.8.5 Time delays

Test condition: See item 1.25.8.1

Test values: 0.00 s $\leq T <$ 60.00 s

Permissive tolerance/Limiting values:
 $|N| \leq 1\%$ of setting value or 10 ms

Test results/Remarks:
 $|N| \leq 1\%$ of setting value or 10 ms

1.25.7 Negative sequence V2

1.25.7.1 Pickup values

Test condition:
 $f_{ovd} = 50$ Hz, 60Hz
0.300 V₀ threshold value \geq 200.000 V

Summary

Permissive tolerance/Limiting values:
In the range $f_{ovd} \pm 10\%$
 $|N| \leq 0.5\%$ of setting value or 0.05 V

Test results/Remarks:
In the range $f_{ovd} \pm 10\%$
 $|N| \leq 0.5\%$ of setting value or 0.05 V

1.25.7.2 Dropout ratio

Test condition: See item 1.25.7.1

Test values: $r =$ settable dropout ratio
0.00 $\leq r <$ 0.09

Permissive tolerance/Limiting values:
 $|N| \leq 0.5\%$ of dropout value or 0.05 V

Test results/Remarks:
 $|N| \leq 0.5\%$ of dropout value or 0.05 V

1.25.7.3 Pickup times

Test condition: See item 1.25.7.1
1.2" threshold value

Permissive tolerance/Limiting values:
1 approx.
Measuring window length 1 cycle: 65ms + OOT
Measuring window length 10 cycles: 210ms + OOT
(depends on the measuring window length) at $f_{ovd} = 50$ Hz

Measuring window length 1 cycle: 48ms + OOT
Measuring window length 10 cycles: 190ms + OOT
(depends on the measuring window length) at $f_{ovd} = 60$ Hz

Test results/Remarks:
1 approx.
Measuring window length 1 cycle: 55ms + OOT
Measuring window length 10 cycles: 210ms + OOT
(depends on the measuring window length) at $f_{ovd} = 60$ Hz

Measuring window length 1 cycle: 48ms + OOT
Measuring window length 10 cycles: 190ms + OOT
(depends on the measuring window length) at $f_{ovd} = 60$ Hz

1.25.7.4 Dropout times

Test condition: See item 1.25.7.1

Permissive tolerance/Limiting values:
1 approx.
Measuring window length 1 cycle: 20ms + OOT
Measuring window length 10 cycles: 70ms + OOT
(depends on the measuring window length)

Test results/Remarks:
1 approx.

Summary

Measuring window length 1 cycle: 20ms + OOT
Measuring window length 10 cycles: 70ms + OOT
(depends on the measuring window length)

1.25.7.5 Time delays

Test condition: See item 1.25.7.1

Test values: 0.00 s $\leq T <$ 60.00 s

Permissive tolerance/Limiting values:
 $|N| \leq 1\%$ of setting value or 10 ms

Test results/Remarks:
 $|N| \leq 1\%$ of setting value or 10 ms

1.25.8 Ratio of negative-sequence to positive-sequence, V2/V1

1.25.8.1 Pickup values

Test condition:
 $f_{ovd} = 50$ Hz, 60Hz
0.5% \pm threshold value \geq 100%

Permissive tolerance/Limiting values:
In the range $f_{ovd} \pm 10\%$
 $|N| \leq 0.5\%$ of setting value or 0.05 V

Test results/Remarks:
In the range $f_{ovd} \pm 10\%$
 $|N| \leq 0.5\%$ of setting value or 0.05 V

1.25.8.2 Dropout ratio

Test condition: See item 1.25.8.1

Test values: $r =$ settable dropout ratio
0.00 $\leq r <$ 0.09

Permissive tolerance/Limiting values:
 $|N| \leq 0.5\%$ of setting value or 0.05 V

Test results/Remarks:
 $|N| \leq 0.5\%$ of setting value or 0.05 V

1.25.8.3 Pickup times

Test condition: See item 1.25.8.1
1.2" threshold value

Permissive tolerance/Limiting values:
1 approx.
Measuring window length 1 cycle: 65ms + OOT
Measuring window length 10 cycles: 210ms + OOT
(depends on the measuring window length) at $f_{ovd} = 50$ Hz

Measuring window length 1 cycle: 48ms + OOT
Measuring window length 10 cycles: 190ms + OOT
(depends on the measuring window length) at $f_{ovd} = 60$ Hz

Test results/Remarks:
1 approx.

Summary

Measuring window length 1 cycle: 55ms + OOT
Measuring window length 10 cycles: 210ms + OOT
(depends on the measuring window length) at $f_{ovd} = 60$ Hz

1.25.8.4 Dropout times

Test condition: See item 1.25.8.1

Permissive tolerance/Limiting values:
1 approx.
Measuring window length 1 cycle: 27ms + OOT
Measuring window length 10 cycles: 85ms + OOT
(depends on the measuring window length) at $f_{ovd} = 50$ Hz

Measuring window length 1 cycle: 18ms + OOT
Measuring window length 10 cycles: 45ms + OOT
(depends on the measuring window length) at $f_{ovd} = 60$ Hz

Test results/Remarks:
1 approx.
Measuring window length 1 cycle: 22ms + OOT
Measuring window length 10 cycles: 55ms + OOT
(depends on the measuring window length) at $f_{ovd} = 50$ Hz

Measuring window length 1 cycle: 18ms + OOT
Measuring window length 10 cycles: 45ms + OOT
(depends on the measuring window length) at $f_{ovd} = 60$ Hz

1.25.8.5 Time delays

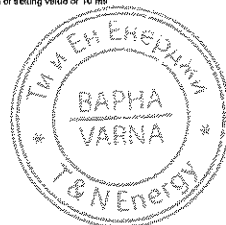
Test condition: See item 1.25.8.1

Test values: 0.00 s $\leq T <$ 60.00 s

Permissive tolerance/Limiting values:
 $|N| \leq 1\%$ of setting value or 10 ms

Test results/Remarks:
 $|N| \leq 1\%$ of setting value or 10 ms

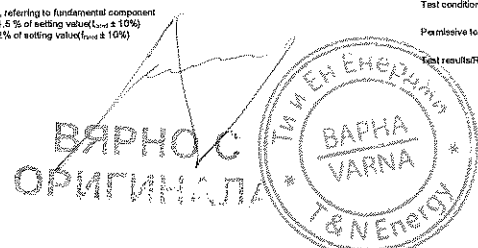
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Summary

1.26	59C Peak Overvoltage Protection for Capacitors	
1.26.1	Specifications	
-	VDE 0436	
-	IEC/EN 60255-1, Item 7, Annex A, B	
-	IEC/EN 60255-127	
1.26.2	Define time stage	
1.26.2.1	Pickup values	
Test condition:	0.80; IIN >> 3.00	
	$f_{load} = 50 \text{ Hz}, 60 \text{ Hz}$	
Permissive tolerance/Limiting values:	33 % part of harmonic, referring to fundamental component Up to 30th harmonic: 1 % of setting value ($f_{load} \pm 10\%$) Up to 50th harmonic: 2 % of setting value ($f_{load} \pm 10\%$)	
Test results/Remarks:	33 % part of harmonic, referring to fundamental component Up to 30th harmonic: 0.5 % of setting value ($f_{load} \pm 10\%$) Up to 50th harmonic: 1.3 % of setting value ($f_{load} \pm 10\%$)	
1.26.2.2	Pickup times	
Test condition:	see item 1.26.2.1	
Permissive tolerance/Limiting values:	t approx. 30 ms + OOT at $f_{load} = 50 \text{ Hz}$ 25 ms + OOT at $f_{load} = 60 \text{ Hz}$	
Test results/Remarks:	< 27ms at 60Hz < 20ms at 60Hz	
1.26.2.3	Operate times	
Test condition:	see item 1.26.2.1	
Permissive tolerance/Limiting values:	1 % of the setting value or 10 ms	
Test results/Remarks:	0 % of the setting value or 8.9 ms	
1.26.3	Inverse time stage	
1.26.3.1	Pickup values	
Test condition:	0.80; IIN >> 3.00	
Permissive tolerance/Limiting values:	33 % part of harmonic, referring to fundamental component Up to 30th harmonic: 1.5 % of setting value ($f_{load} \pm 10\%$) Up to 60th harmonic: 2 % of setting value ($f_{load} \pm 10\%$)	
Test results/Remarks:	33 % part of harmonic, referring to fundamental component Up to 30th harmonic: 1.5 % of setting value ($f_{load} \pm 10\%$) Up to 50th harmonic: 2 % of setting value ($f_{load} \pm 10\%$)	
1.26.3.2	Pickup times	
Test condition:	see item 1.26.2.1	



Summary

Permissive tolerance/Limiting values:	t approx. 40 ms + OOT at $f_{load} = 50 \text{ Hz}$ 30 ms + OOT at $f_{load} = 60 \text{ Hz}$
Test results/Remarks:	< 40ms at 60Hz < 30ms at 60Hz
1.26.3.3	Operate times
Test condition:	see item 1.26.2.1
Permissive tolerance/Limiting values:	1 % of the setting value or 30 ms
Test results/Remarks:	2.8 % of the setting value or 16 ms
1.26.3.4	Droptout times
Permissive tolerance/Limiting values:	1 % of set point value or 30 ms
Test results/Remarks:	1 % of set point value or 30 ms
1.26.4	User curve stage
1.26.4.1	Pickup values
Test condition:	0.80; IIN >> 3.00
Permissive tolerance/Limiting values:	33 % part of harmonic, referring to fundamental component Up to 30th harmonic: 1 % of setting value ($f_{load} \pm 10\%$) Up to 50th harmonic: 2 % of setting value ($f_{load} \pm 10\%$)
Test results/Remarks:	33 % part of harmonic, referring to fundamental component Up to 30th harmonic: 0.5 % of setting value ($f_{load} \pm 10\%$) Up to 50th harmonic: 1.3 % of setting value ($f_{load} \pm 10\%$)
1.26.4.2	Pickup times
Test condition:	see item 1.26.2.1
Permissive tolerance/Limiting values:	t approx. 30 ms + OOT at $f_{load} = 50 \text{ Hz}$ 25 ms + OOT at $f_{load} = 60 \text{ Hz}$
Test results/Remarks:	< 35ms at 60Hz < 20ms at 60Hz
1.26.4.3	Operate times
Test condition:	see item 1.26.2.1
Permissive tolerance/Limiting values:	1 % of set point value + 1 % current tolerance or 30 ms
Test results/Remarks:	2.8 % of set point value or 16 ms

Summary

1.27	27 Undervoltage Protection	
1.27.1	Specifications	
-	VDE 0436	
-	IEC/EN 60255-1, Item 7, Annex A, B	
-	IEC/EN 60255-127	
1.27.2	3ph Voltage ph-to-gnd, ph-to-ph define time with definite time undervoltage stages	
1.27.2.1	Pickup values	
Test condition:	fundamental components, RMS values 0.300 V < threshold value < 175.000 V	
Permissive tolerance/Limiting values:	In the range $f_{load} \pm 10\%$ $ U \pm 0.5\%$ of setting value or 0.05 V	
Test results/Remarks:	In the range $f_{load} \pm 10\%$ $ U \pm 0.5\%$ of setting value or 0.05 V	
1.27.2.2	Droptout ratio	
Test condition:	see item 1.27.2.1	
Test values:	r = stable droptout ratio 1.01 < r < 1.20	
Permissive tolerance/Limiting values:	$ U \pm 0.5\%$ of droptout value or 0.05 V	
Test results/Remarks:	$ U \pm 0.5\%$ of droptout value or 0.05 V	
1.27.2.3	Pickup times	
Test condition:	see item 1.27.2.1 0.8" threshold value no pickup delay	
Permissive tolerance/Limiting values:	t approx. 25 ms + OOT at $f_{load} = 50 \text{ Hz}$ 22 ms + OOT at $f_{load} = 60 \text{ Hz}$	
Test results/Remarks:	t approx. 25 ms + OOT at $f_{load} = 50 \text{ Hz}$ 22 ms + OOT at $f_{load} = 60 \text{ Hz}$	
1.27.2.4	Pickup delay	
Test condition:	see item 1.27.2.1 0.8" pickup value	
Permissive tolerance/Limiting values:	t approx. 40 ms	
Test results/Remarks:	t approx. 40 ms	
1.27.2.5	Droptout times	
Test condition:	see item 1.27.2.1	

Summary

Permissive tolerance/Limiting values:	t approx. 20 ms + OOT
Test results/Remarks:	t approx. 20 ms + OOT
1.27.2.6	Time delays
Test condition:	see item 1.27.2.1
Test values:	0.00 s < T < 60.00 s
Permissive tolerance/Limiting values:	$ U \pm 1\%$ of setting value or 10 ms
Test results/Remarks:	$ U \pm 1\%$ of setting value or 10 ms
1.27.3	3ph Voltage ph-to-gnd, ph-to-ph with inverse time undervoltage stages
1.27.3.1	Pickup values
Test condition:	fundamental components, RMS values 0.300 V < threshold value < 175.000 V
Permissive tolerance/Limiting values:	In the range $f_{load} \pm 10\%$ $ U \pm 0.5\%$ of setting value or 0.05 V
Test results/Remarks:	In the range $f_{load} \pm 10\%$ $ U \pm 0.5\%$ of setting value or 0.05 V
1.27.3.2	Droptout ratio
Test condition:	see item 1.27.3.1
Test values:	1.05
Permissive tolerance/Limiting values:	$ U \pm 0.5\%$ of droptout value or 0.05 V
Test results/Remarks:	$ U \pm 0.5\%$ of droptout value or 0.05 V
1.27.3.3	Pickup times
Test condition:	see item 1.27.3.1 0.8" pickup value no pickup delay
Permissive tolerance/Limiting values:	t approx. 25 ms + OOT at $f_{load} = 50 \text{ Hz}$ 22 ms + OOT at $f_{load} = 60 \text{ Hz}$
Test results/Remarks:	t approx. 25 ms + OOT at $f_{load} = 50 \text{ Hz}$ 22 ms + OOT at $f_{load} = 60 \text{ Hz}$
1.27.3.4	Pickup delay
Test condition:	see item 1.27.3.1 0.8" pickup value



Summary

Permissive tolerance/Limiting values:	1 approx. 40 ms
Test results/Remarks:	1 approx. 40 ms
1.27.3.5 Dropout times	
Test condition:	see item 1.27.3.1 with no reset time
Permissive tolerance/Limiting values:	1 approx. 20 ms + OOT
Test results/Remarks:	1 approx. 20 ms + OOT
1.27.3.6 Inverse time characteristics	
Test condition:	see item 1.27.3.1 0.8" threshold value
Test values:	Character constant k: 0.00 .. k .. 300.00 Character constant c: 0.010 .. c .. 5.000 Character constant e: 0.000 .. e .. 5.000 Time dist: 0.05 .. T .. 15.00
Permissive tolerance/Limiting values:	5 % of setting value or 30 ms
Test results/Remarks:	5 % of setting value or 30 ms
1.27.3.7 Definite Time delays	
Test condition:	see item 1.27.3.1
Test values:	0.00 s ≤ T ≤ 60.00 s
Permissive tolerance/Limiting values:	[δ] : 1 % of setting value or 10 ms
Test results/Remarks:	[δ] : 1 % of setting value or 10 ms
1.27.3.8 Reset Time	
Test condition:	see item 1.27.3.1
Test values:	0.00 s .. T .. 60.00 s
Permissive tolerance/Limiting values:	[δ] : 1 % of setting value or 10 ms
Test results/Remarks:	[δ] : 1 % of setting value or 10 ms
1.27.4 Positive-Sequence Voltage V1	
1.27.4.1 Pickup values	
Test condition:	fundamental components, RMS values 0.300 V ≤ threshold value ≤ 200.000 V

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Summary

Permissive tolerance/Limiting values:	In the range $f_{over} \pm 10\%$ [δ] : 0.5 % of setting value or 0.05 V
Test results/Remarks:	In the range $f_{over} \pm 10\%$ [δ] : 0.5 % of setting value or 0.05 V
1.27.4.2 Dropout ratio	
Test condition:	see item 1.27.4.1
Test values:	r = selectable dropout ratio 1.01 ≤ r ≤ 1.20
Permissive tolerance/Limiting values:	[δ] : 0.5 % of dropout value or 0.05 V
Test results/Remarks:	[δ] : 0.5 % of dropout value or 0.05 V
1.27.4.3 Pickup times	
Test condition:	see item 1.27.4.1 0.8" threshold value
Permissive tolerance/Limiting values:	1 approx. 25 ms + OOT at $f_{over} = 50$ Hz 22 ms + OOT at $f_{over} = 60$ Hz
Test results/Remarks:	1 approx. 25 ms + OOT at $f_{over} = 50$ Hz 22 ms + OOT at $f_{over} = 60$ Hz
1.27.4.4 Dropout times	
Test condition:	see item 1.27.4.1
Permissive tolerance/Limiting values:	1 approx. 20 ms + OOT
Test results/Remarks:	1 approx. 20 ms + OOT
1.27.4.6 Time delays	
Test condition:	see item 1.27.4.1
Test values:	0.00 s ≤ T ≤ 60.00 s
Permissive tolerance/Limiting values:	[δ] : 1 % of setting value or 10 ms
Test results/Remarks:	[δ] : 1 % of setting value or 10 ms
1.27.6 Any Voltage Vx	
1.27.6.1 Pickup values	
Test condition:	fundamental components, RMS values 0.300 V ≤ threshold value ≤ 200.000 V
Permissive tolerance/Limiting values:	In the range $f_{over} \pm 10\%$ [δ] : 0.5 % of setting value or 0.05 V

Summary

Test results/Remarks:	In the range $f_{over} \pm 10\%$ [δ] : 0.5 % of setting value or 0.05 V
1.27.6.2 Dropout ratio	
Test condition:	see item 1.27.6.1
Test values:	r = selectable dropout ratio 1.01 ≤ r ≤ 1.20
Permissive tolerance/Limiting values:	[δ] : 0.5 % of dropout value or 0.05 V
Test results/Remarks:	[δ] : 0.5 % of dropout value or 0.05 V
1.27.6.3 Pickup times	
Test condition:	see item 1.27.6.1 0.8" threshold value
Permissive tolerance/Limiting values:	1 approx. 25 ms + OOT at $f_{over} = 50$ Hz 22 ms + OOT at $f_{over} = 60$ Hz
Test results/Remarks:	1 approx. 25 ms + OOT at $f_{over} = 50$ Hz 22 ms + OOT at $f_{over} = 60$ Hz
1.27.6.4 Dropout times	
Test condition:	see item 1.27.6.1
Permissive tolerance/Limiting values:	1 approx. 20 ms + OOT
Test results/Remarks:	1 approx. 20 ms + OOT
1.27.6.5 Time delays	
Test condition:	see item 1.27.6.1
Test values:	0.00 s ≤ T ≤ 60.00 s
Permissive tolerance/Limiting values:	[δ] : 1 % of setting value or 10 ms
Test results/Remarks:	[δ] : 1 % of setting value or 10 ms

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T&N ENERGY

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Summary

1.28 27 Under-Voltage-Protection 1ph	
1.28.1 Specifications	
	- VDE 0435 - IEC/EN 60255-1, item 7, Annex A, B - IEC60255-127
1.28.2 Any voltage Vx	
1.28.2.1 Pickup values Ux	
Test condition:	fundamental components - RMS values - 0.300 V ≤ V _{set} ≤ 175.000 V
Test values:	fundamental components - RMS values - 0.300 V ≤ V _{set} ≤ 175.000 V f = 50 Hz, 60 Hz
Permissive tolerance/Limiting values:	In the range $f_{over} \pm 10\%$ [δ] : 0.5 % of setting value or 0.5 V
Test results/Remarks:	confirmed
1.28.2.2 Dropout ratio	
Test condition:	r = selectable dropout ratio 1.01 ≤ r ≤ 1.20
Test values:	R = selectable dropout ratio 1.01 ≤ r ≤ 1.20
Test results/Remarks:	confirmed
1.28.2.3 Pickup time	
Test condition:	see item 1.28.2.1
Test values:	1 in ms
Permissive tolerance/Limiting values:	1 approx. 25 ms + OOT at 50 Hz 22 ms + OOT at 60 Hz
Test results/Remarks:	confirmed
Dropout times	
Test condition:	see item 1.28.2.1
Test values:	see item 1.28.2.1

Summary

1.28.2.4 Permissive tolerance/Limiting values: t approx.
20 ms + OOT

Test results/Remarks: confirmed

Time delays: added to the inherent operating times

Test condition: 0.00 s ≤ T ≤ 60.00 s

Test values: 0.00 s ≤ T ≤ 60.00 s

Permissive tolerance/Limiting values: $|N|$ 1 % of setting value or 10 ms

Test results/Remarks: $|N|$ < 1 % or 10 ms

Summary

1.28.1 81 Frequency Protection

1.28.1.1 Specifications

- VDE 0435
- IEC/EN 60255-1, item 7, Annex A, B

1.28.2 Pickup values f_c, f_p

Test condition: 40.00 Hz ≤ f ≤ 70.00 Hz
Method A: Angle difference method
Method B: Filtering method

Test values: A: Infeed - 0.2 Hz < f < Infeed + 0.2 Hz
B: Infeed - 3.0 Hz < f < Infeed + 3.0 Hz

Permissive tolerance/Limiting values: A: ± 5 mHz at V = Vrated
B: ± 10 mHz at V = Vrated

Test results/Remarks: A: ± 5 mHz at V = Vrated
B: ± 10 mHz at V = Vrated

1.28.3 Dropout ratio Δf

Test condition: 20 mHz to 2000 mHz

Permissive tolerance/Limiting values: ± 5 mHz at V = Vrated

Test results/Remarks: ± 5 mHz at V = Vrated

1.28.3.1 Pickup times t_c, t_p

Permissive tolerance/Limiting values:

Method A:
t approx.
70 ms + OOT at Infeed = 50 Hz
60 ms + OOT at Infeed = 60 Hz

Method B:
t approx.
75 ms + OOT at Infeed = 50 Hz
76 ms + OOT at Infeed = 60 Hz

Test results/Remarks:

Method A:
t < 70 ms + OOT at Infeed = 50 Hz
< 60 ms + OOT at Infeed = 60 Hz

Method B:
t < 75 ms + OOT at Infeed = 50 Hz
< 75 ms + OOT at Infeed = 60 Hz

1.28.3.2 Dropout times t_c, t_p

Test values: dropout by I, V → 0

Permissive tolerance/Limiting values: 60 ms ≤ t ≤ 80 ms

Test results/Remarks: 60 ms ≤ t ≤ 80 ms

Summary

1.28.3.3 Time delays

Test condition: added to the inherent operating times

Test values: 0.00 s ≤ T ≤ 60.00 s

Permissive tolerance/Limiting values: $|N|$ ≥ 1 % of setting value or 10 ms

Test results/Remarks: $|N|$ < 1 % or 10 ms

1.28.4 Positive or negative sequence V1, V2

1.28.4.1 Pickup values

Test condition: 0.300 V ≤ V ≤ 200.000 V

Permissive tolerance/Limiting values: $|N|$ ≥ 0.5 % of setting value or 0.5 V

Test results/Remarks: $|N|$ ≥ 0.5 % of setting value or 0.5 V

1.28.4.2 Dropout ratio

Test condition: r = settable dropout ratio
0.00 ≤ r ≤ 0.99

Test results/Remarks: confirmed

1.28.4.3 Pickup times

Permissive tolerance/Limiting values: t approx.
25 ms + OOT at Infeed = 50 Hz
22 ms + OOT at Infeed = 60 Hz

Test results/Remarks: t < 25 ms + OOT at Infeed = 50 Hz
< 22 ms + OOT at Infeed = 60 Hz

1.28.4.4 Dropout times

Permissive tolerance/Limiting values: t approx.
20 ms + OOT

Test results/Remarks: t < 20 ms + OOT

1.28.4.5 Time delays

Test condition: added to the inherent operating times

Test values: 0.00 s ≤ T ≤ 60.00 s

Permissive tolerance/Limiting values: ± 1% of setting value or 10ms

Test results/Remarks: $|N|$ < 1 % or 10 ms

Summary

1.28.4.6 Operating ranges

Permissive tolerance/Limiting values:

Method A:
5 V ≤ V_{ph} ≤ 230 V
10 Hz ≤ f ≤ 60 Hz

Method B:
5 V ≤ V_{ph} ≤ 230 V
25 Hz ≤ f ≤ 80 Hz

Test results/Remarks:

Method A:
5 V ≤ V_{ph} ≤ 230 V
10 Hz ≤ f ≤ 60 Hz

Method B:
5 V ≤ V_{ph} ≤ 230 V
25 Hz ≤ f ≤ 80 Hz



Summary

1.3.0	81R Rate of Frequency Change
1.3.0.1	Specifications
-	VDE 0435
-	IECEN 60255-1, Item 7, Annex A, B
1.3.0.2	df/dt falling
1.3.0.2.1	Pickup values
Test condition:	0.8 s ffrated ≤ 1.1
Test values:	0.10 Hz/s ≤ df/dt ≤ 20.00 Hz/s
Permissive tolerance/Limiting values:	< 5 % of set point value or 0.1 Hz/s
Test results/Remarks:	Measuring window ≤ 3 periods < 5 %; < 0.06 Hz/s Measuring window > 3 periods < 3 %; < 0.06 Hz/s
1.3.0.2.2	Dropout differential
Test condition:	0.9 s ffrated ≤ 1.1
Test values:	0.02 Hz/s Dropout differential ≤ 0.99 Hz/s
Permissive tolerance/Limiting values:	< 5 % of Dropout value or 0.1 Hz/s
Test results/Remarks:	Measuring window ≤ 3 periods < 5 %; < 0.06 Hz/s Measuring window > 3 periods < 3 %; < 0.06 Hz/s
1.3.0.2.3	Pickup times
Test condition:	0.10 Hz/s ≤ df/dt ≤ 20.00 Hz/s
Test results/Remarks:	Approx. 165 ms to 225 ms (depends on measuring window length)
1.3.0.2.4	Dropout times
Test condition:	0.10 Hz/s ≤ df/dt ≤ 20.00 Hz/s
Test results/Remarks:	Approx. 165 ms to 225 ms (depends on measuring window length)
1.3.0.2.5	Time delays
Test condition:	Added to the inherent operating times
Test values:	0.00 s to 60.00 s
Permissive tolerance/Limiting values:	- 1 % of setting value or 10 ms
Test results/Remarks:	- 1 % or 10 ms

Summary

1.3.0.3	df/dt rising
1.3.0.3.1	Pickup values
Test condition:	0.8 s ffrated ≤ 1.1
Test values:	0.10 Hz/s ≤ df/dt ≤ 20.00 Hz/s
Permissive tolerance/Limiting values:	< 5 % of set point value or 0.1 Hz/s
Test results/Remarks:	Measuring window ≤ 3 periods < 5 %; < 0.06 Hz/s Measuring window > 3 periods < 3 %; < 0.06 Hz/s
1.3.0.3.2	Dropout differential
Test condition:	0.9 s ffrated ≤ 1.1
Test values:	0.02 Hz/s Dropout differential ≤ 0.99 Hz/s
Permissive tolerance/Limiting values:	< 5 % of Dropout value or 0.1 Hz/s
Test results/Remarks:	Measuring window ≤ 3 periods < 5 %; < 0.06 Hz/s Measuring window > 3 periods < 3 %; < 0.06 Hz/s
1.3.0.3.3	Pickup times
Test condition:	0.10 Hz/s ≤ df/dt ≤ 20.00 Hz/s
Test results/Remarks:	Approx. 165 ms to 225 ms (depends on measuring window length)
1.3.0.3.4	Dropout times
Test condition:	0.10 Hz/s ≤ df/dt ≤ 20.00 Hz/s
Test results/Remarks:	Approx. 165 ms to 225 ms (depends on measuring window length)
1.3.0.3.5	Time delays
Test condition:	Added to the inherent operating times
Test values:	0.00 s to 60.00 s
Permissive tolerance/Limiting values:	- 1 % of setting value or 10 ms
Test results/Remarks:	- 1 % or 10 ms

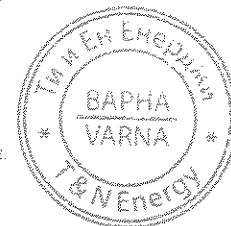
Summary

1.3.1	32 General Power Protection 3-phases
1.3.1.1	Specifications
-	VDE 0435
-	IECEN 60255-1, item 7, Annex A, B
1.3.1.2	Pickup values
Test condition:	-200.0 % to +200.0 %
Test values:	-200.0 % to +200.0 %
Permissive tolerance/Limiting values:	f ≤ 0.5 % Sn, ± 3 % of setting value
Test results/Remarks:	f < 0.5 % Sn, ± 3 % of setting value
1.3.1.3	Tilt power characteristic
Test condition:	-89.0 ° to +89.0 °
Test values:	-89.0 ° to +89.0 °
Permissive tolerance/Limiting values:	function according to manual
Test results/Remarks:	function correct
1.3.1.4	Dropout ratio
Test condition:	0.80 to 0.90 at >stage 1.01 to 1.10 at <stage
Test values:	0.80 to 0.99 at >stage 1.01 to 1.10 at <stage
Permissive tolerance/Limiting values:	function according to manual
Test results/Remarks:	function correct
1.3.1.5	Pickup times
Permissive tolerance/Limiting values:	t approx. 65 ms + OOT at ffrated = 50 Hz 45 ms + OOT at ffrated = 60 Hz
Test results/Remarks:	t < 65 ms + OOT at ffrated = 50 Hz < 45 ms + OOT at ffrated = 60 Hz
1.3.1.6	Dropout times
Permissive tolerance/Limiting values:	t approx. 65 ms + OOT at ffrated = 50 Hz 45 ms + OOT at ffrated = 60 Hz

Summary

Test results/Remarks:	t < 65 ms + OOT at ffrated = 50 Hz < 45 ms + OOT at ffrated = 60 Hz
1.3.1.7	Time delays
Test condition:	added to the inherent operating times
Test values:	0.00 s to 60.00 s
Permissive tolerance/Limiting values:	f ≤ 1 % of setting value or 10 ms
Test results/Remarks:	f 1 % or 10 ms

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Summary

1.32 32R Reverse Power Protection
1.32.1 Specifications

- VDE 0435
- IEC/EN 60255-1, Item 7, Annex A, B

1.32.2 Angle correction

Test condition: $-10.00^\circ \leq \text{Angle correction} \leq 10.00^\circ$
 Test values: $-10.00^\circ \leq \text{Angle correction} \leq 10.00^\circ$
 Permissive tolerance/limiting values: $0.15\% S_n$ or 5% of Setting values when $Q < 0.5S_n$
 Test results/Remarks: $0.15\% S_n$ or 5% of Setting values when $Q < 0.5S_n$

1.32.3 Minimum voltage V1

Test condition: $0.300 \text{ V} \leq \text{Minimum voltage V1} \leq 60.000 \text{ V}$
 $f_{max} = 60 \text{ Hz}, 60 \text{ Hz}$
 Test values: $0.300 \text{ V} \leq \text{Minimum voltage V1} \leq 60.000 \text{ V}$
 Permissive tolerance/limiting values: $|S| \leq 0.5\%$ of dropout value or 0.05 V
 Test results/Remarks: $|S| \leq 0.5\%$ of dropout value or 0.05 V

1.32.4 Threshold

Test condition: $-30.00\% \leq \text{threshold value} \leq -0.30\%$
 $f_{max} = 50 \text{ Hz}, 60 \text{ Hz}$
 Test values: $-30.00\% \leq \text{threshold value} \leq -0.30\%$
 Permissive tolerance/limiting values: $0.15\% S_n$ or 5% of Setting values when $Q < 0.5S_n$
 Test results/Remarks: $0.15\% S_n$ or 5% of Setting values when $Q < 0.5S_n$

1.32.5 Dropout ratio

Test condition: $-30.00\% \leq \text{threshold value} \leq -0.30\%$
 $0.40 \leq \text{threshold value} \leq 0.60$
 Test values: $0.40 \leq \text{threshold value} \leq 0.60$
 Permissive tolerance/limiting values: $0.15\% S_n$ or 5% of Setting values when $Q < 0.5S_n$
 Test results/Remarks: $0.15\% S_n$ or 5% of Setting values when $Q < 0.5S_n$

1.32.6 Pickup time

Test condition: Threshold = -1.00%
 $f_{max} = 50 \text{ Hz}, 60 \text{ Hz}$
 from 0 to 1.20° Threshold value

Summary

Permissive tolerance/limiting values: t approx.
 $350 \text{ ms} + \text{OOT at } 50 \text{ Hz}$
 $300 \text{ ms} + \text{OOT at } 60 \text{ Hz}$

Test results/Remarks: t approx.
 $342 \text{ ms} + \text{OOT at } 50 \text{ Hz}$
 $296 \text{ ms} + \text{OOT at } 60 \text{ Hz}$

1.32.7 Dropout times

Test condition: Threshold = -1.00%
 $f_{max} = 50 \text{ Hz}, 60 \text{ Hz}$
 from 1.20° Threshold value to 0.44° dropout value

Permissive tolerance/limiting values: t approx.
 $350 \text{ ms} + \text{OOT at } 50 \text{ Hz}$
 $300 \text{ ms} + \text{OOT at } 60 \text{ Hz}$

Test results/Remarks: t approx.
 $232 \text{ ms} + \text{OOT at } 50 \text{ Hz}$
 $184 \text{ ms} + \text{OOT at } 60 \text{ Hz}$

1.32.8 Dropout delay

Test condition: see item 1.32.7
 Test values: $0.00 \text{ s} \leq T \leq 60.00 \text{ s}$
 Permissive tolerance/limiting values: $|S| \leq 1\%$ of setting value or 10 ms
 Test results/Remarks: $|S| \leq 1\%$ of setting value or 10 ms

1.32.9 Operate delay

Test condition: See item 1.32.8
 Test values: $0.00 \text{ s} \leq T \leq 60.00 \text{ s}$
 Permissive tolerance/limiting values: $|S| \leq 1\%$ of setting value or 10 ms
 Test results/Remarks: $|S| \leq 1\%$ of setting value or 10 ms

1.32.10 Operate delay stop valve

Test condition: See item 1.32.8
 Test values: $0.00 \text{ s} \leq T \leq 60.00 \text{ s}$
 Permissive tolerance/limiting values: $|S| \leq 1\%$ of setting value or 10 ms
 Test results/Remarks: $|S| \leq 1\%$ of setting value or 10 ms

Summary

1.33 24 Overexcitation Protection
1.33.1 Specifications

- VDE 0435
- IEC/EN 60255-1, Item 7, Annex A, B

1.33.2 General Test conditions

f_{test} : $60 \text{ Hz}, 60 \text{ Hz}$
 V_{test} : 100 V

1.33.3 Definite Time

1.33.3.1 V/I Threshold

Test condition: $1.00 \leq V/I \leq 1.40$
 Permissive tolerance/limiting values: $|S| \leq 2\%$ of setting value
 Test results/Remarks: $|S| < 2\%$

1.33.3.2 Dropout ratio

Test condition: see item 1.33.3.1
 Test values: see item 1.33.3.1
 Permissive tolerance/limiting values: r approx. 0.08
 Test results/Remarks: $0.09 \leq r \leq 0.09$

1.33.3.3 Pickup Times

Test condition: see item 1.33.3.1
 Test values: $1.00 \leq V/I \leq 1.40$
 Permissive tolerance/limiting values: t approx.
 $33 \text{ ms} + \text{OOT at } 50 \text{ Hz}$
 $30 \text{ ms} + \text{OOT at } 60 \text{ Hz}$
 Test results/Remarks: t approx.
 $< 33 \text{ ms} + \text{OOT at } 50 \text{ Hz}$
 $< 30 \text{ ms} + \text{OOT at } 60 \text{ Hz}$

1.33.3.4 Dropout times

Test condition: see item 1.33.3.1
 Test values: $1.00 \leq V/I \leq 1.40$
 Permissive tolerance/limiting values: t approx.
 $10 \text{ ms} + \text{OOT at } 50 \text{ Hz}$
 $10 \text{ ms} + \text{OOT at } 60 \text{ Hz}$

Summary

Test results/Remarks: t approx.
 $< 10 \text{ ms} + \text{OOT at } 50 \text{ Hz}$
 $< 10 \text{ ms} + \text{OOT at } 60 \text{ Hz}$

1.33.3.5 Time delays

Test condition: added to the inherent operating times
 Test values: $0.00 \text{ s} \leq T \leq 60.00 \text{ s}$
 Permissive tolerance/limiting values: $|S| \leq 1\%$ of setting value or 10 ms
 Test results/Remarks: $|S| \leq 1\%$ of setting value or 10 ms

1.33.4 Thermal Characteristic

1.33.4.1 V/I Threshold

Test condition: $1.00 \leq V/I \leq 1.20$
 Permissive tolerance/limiting values: $|S| \leq 2\%$ of setting value
 Test results/Remarks: $|S| < 2\%$

1.33.4.2 Dropout ratio

Test condition: see item 1.33.4.1
 Test values: see item 1.33.4.1
 Permissive tolerance/limiting values: r approx. 0.08
 Test results/Remarks: $0.09 \leq r \leq 0.09$

1.33.4.3 Pickup Times

Test condition: see item 1.33.4.1
 Test values: $1.00 \leq V/I \leq 1.20$
 Permissive tolerance/limiting values: t approx.
 $33 \text{ ms} + \text{OOT at } 50 \text{ Hz}$
 $30 \text{ ms} + \text{OOT at } 60 \text{ Hz}$
 Test results/Remarks: t approx.
 $< 33 \text{ ms} + \text{OOT at } 50 \text{ Hz}$
 $< 30 \text{ ms} + \text{OOT at } 60 \text{ Hz}$

1.33.4.4 Dropout times

Test condition: see item 1.33.4.1
 Test values: $1.00 \leq V/I \leq 1.20$
 Permissive tolerance/limiting values: t approx.
 $10 \text{ ms} + \text{OOT at } 50 \text{ Hz}$
 $10 \text{ ms} + \text{OOT at } 60 \text{ Hz}$



Summary

Test results/Remarks:	t approx. 45 ms + OOT at 50 Hz 45 ms + OOT at 60 Hz
1.33.4.5 Cooling time therm. replica	
Test condition:	added to the inherent operating times
Test values:	0 s ≤ T ≤ 100000 s
Permissive tolerance/Limiting values:	t ≤ 1 % of setting value or 10 ms
Test results/Remarks:	t ≤ 1 % of setting value or 10 ms
1.33.4.6 Operate curve	
Test condition:	1.00 p.u. ± V/I ≤ 10.00 p.u. 0 s ≤ t ≤ 100000 s
Test values:	1.00 p.u. ± V/I ≤ 10.00 p.u. 0 s ≤ t ≤ 100000 s
Permissive tolerance/Limiting values:	t ≤ 5 % in relation to V/I, ± 600ms
Test results/Remarks:	t ≤ 5 % in relation to V/I, ± 600ms
1.33.5 Frequency Operating Range	
Frequency manual update:	10 Hz to 80 Hz
Test results/Remarks:	confirmed

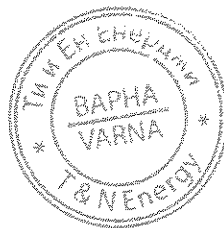
Summary

1.34	27 Undervoltage-controlled Reactive Power Protection
1.34.1	Specifications
	- VDE 8455 - IEC/EN 60255-1, item 7, Annex A, B - IEC/EN 60255-127
1.34.2	Protection stage
1.34.2.1	Pickup values Vc
Test condition:	f _{test} = 50 Hz, 60 Hz 3.000 V ≤ V _c ≤ 175.000 V
Test values:	3.000 V ≤ V _c ≤ 175.000 V
Permissive tolerance/Limiting values:	< 0.5 % of set point value or 0.05 V
Test results/Remarks:	< 0.5 % of set point value or 0.05 V
1.34.2.2	V dropout ratio
Test condition:	f _{test} = 50 Hz, 60 Hz r = dropout ratio
Test values:	r = 1.05
Test results/Remarks:	1.01 ≤ r ≤ 1.20
1.34.2.3	Pickup values I1D
Test condition:	0.030 A ≤ I1D ≤ 10.000 I _{rated}
Test values:	f _{test} = 50 Hz, 60 Hz
Permissive tolerance/Limiting values:	1 % of setting value or 0.005 I _{rated}
Test results/Remarks:	1 % of setting value or 0.005 I _{rated}
1.34.2.4	Dropout ratio release current
Test condition:	f _{test} = 50 Hz, 60 Hz r = dropout ratio
Test values:	r = 0.95
Test results / remarks:	0.90 ≤ r ≤ 0.99
1.34.2.5	Pickup values Qc
Test condition:	f _{test} = 50 Hz, 60 Hz 1.0% ≤ Q _c ≤ 200.0%
Test values:	1.0% ≤ Q _c ≤ 200.0%
Permissive tolerance/Limiting values:	< 0.5 % S _{rated} ± 3 % of setting value

Summary

Test results / remarks:	< 0.5 % S _{rated} ± 3 % of setting value
1.34.2.6	Q dropout ratio
Test condition:	f _{test} = 50 Hz, 60 Hz r = dropout ratio
Test values:	r = 0.95
Test results / remarks:	0.90 ≤ r ≤ 0.99
1.34.2.7	Pickup time
Test condition:	see item 1.34.2.1, 1.34.2.3, 1.34.2.5
Test values:	f _{test} = 50 Hz, 60 Hz
Permissive tolerance/Limiting values:	t approx. 55 ms + OOT at f _{test} = 50 Hz 45 ms + OOT at f _{test} = 60 Hz
Test results/Remarks:	t approx. 55 ms + OOT at f _{test} = 50 Hz 45 ms + OOT at f _{test} = 60 Hz
1.34.2.8	Dropout times
Test condition:	see item 1.34.2.1, 1.34.2.3, 1.34.2.5
Test values:	f _{test} = 50 Hz, 60 Hz
Permissive tolerance/Limiting values:	t approx. 55 ms + OOT at f _{test} = 50 Hz 45 ms + OOT at f _{test} = 60 Hz
Test results/Remarks:	t approx. 55 ms + OOT at f _{test} = 50 Hz 45 ms + OOT at f _{test} = 60 Hz
1.34.2.9	Time delays
Test condition:	added to the inherent operating times
Test values:	0.50 s ≤ T ≤ 60.00 s
Permissive tolerance/Limiting values:	t ≤ 1 % of setting value or 10 ms
Test results/Remarks:	t ≤ 1 % of setting value or 10 ms
1.34.2.10	Operate delay generator CB
Test condition:	added to the inherent operating times
Test values:	0.00 s ≤ T ≤ 60.00 s
Permissive tolerance/Limiting values:	t ≤ 1 % of setting value or 10 ms

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Test results/Remarks:	t ≤ 1 % of setting value or 10 ms
1.34.2.11	Operate delay grid CB
Test condition:	added to the inherent operating times
Test values:	0.00 s ≤ T ≤ 60.00 s
Permissive tolerance/Limiting values:	t ≤ 1 % of setting value or 10 ms
Test results/Remarks:	t ≤ 1 % of setting value or 10 ms
1.34.3	Recloser stage
1.34.3.1	V ₀ reclosure threshold
Test condition:	f _{test} = 50 Hz, 60 Hz 3.000 V ≤ V ₀ ≤ 340.000 V
Test values:	3.000 V ≤ V ₀ ≤ 340.000 V
Permissive tolerance/Limiting values:	< 0.5 % of set point value or 0.05V
Test results/Remarks:	< 0.5 % of set point value or 0.05V
1.34.3.2	V dropout ratio
Test condition:	f _{test} = 50 Hz, 60 Hz r = dropout ratio
Test values:	r = 0.95
Test results / remarks:	0.90 ≤ r ≤ 0.99
1.34.3.3	f-difference positive
Test condition:	0.01 Hz to 5.00 Hz
Test values:	0.01 Hz to 5.00 Hz
Permissive tolerance/Limiting values:	10 mHz
Test results/Remarks:	10 mHz
1.34.3.4	f-difference negative
Test condition:	-5.00 Hz to -0.01 Hz
Test values:	-5.00 Hz to -0.01 Hz
Permissive tolerance/Limiting values:	10 mHz
Test results/Remarks:	10 mHz

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Summary

1.34.3.5 I_p release threshold	
Test condition:	0.030 I _{rated} ≤ I _p ≤ 10.000 I _{rated}
Test values:	f _{test} = 50 Hz, 60 Hz
Permissive tolerance/Limiting values:	± 1 % of setting value or 0.005 I _{rated}
Test results/Remarks:	± 1 % of setting value or 0.005 I _{rated}
1.34.3.8 Dropout ratio release current	
Test condition:	f _{test} = 50 Hz, 60 Hz r = dropout ratio
Test values:	r = 0.95
Test results/Remarks:	0.90 ≤ r ≤ 0.99
1.34.3.7 Time delay	
Test condition:	0.00 s ≤ T ≤ 3600.00 s
Test values:	0.00 s ≤ T ≤ 3600.00 s
Permissive tolerance/Limiting values:	± 1% of setting value or 10 ms
Test results/Remarks:	± 1% of setting value or 10 ms

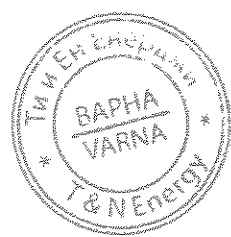
Summary

1.35 50BF Circuit Breaker Failure Protection	
1.35.1 General test conditions	
f _{test}	50 Hz, 60 Hz
I _{rated}	1 A, 5 A
1.35.2 Pickup values	
Test condition:	0.030 I _{rated} ≤ I _p ≤ 35.000 I _{rated}
Permissive tolerance/Limiting values:	± 2 % of setting value or 1 % I _{rated}
Test results/Remarks:	< 2 % or 1 % I _{rated}
1.35.3 Dropout ratio	
Test condition:	approx. 0.95
Permissive tolerance/Limiting values:	± 2 % of setting value or 1 % I _{rated}
Test results/Remarks:	< 2 % of setting value or 1 % I _{rated}
1.35.4 Pickup times	
1.35.4.1 Pickup time, in the case of an internal start	
Test condition:	pickup time, in the case of an internal start
Permissive tolerance/Limiting values:	≤ 10 ms
Test results/Remarks:	< 1 ms
1.35.4.2 Pickup time, in the case of an external start	
Test condition:	pickup time, in the case of an external start
Permissive tolerance/Limiting values:	≤ 10 ms
Test results/Remarks:	< 5 ms
1.35.5 Dropout times	
1.35.5.1 Dropout time via the current-flow criterion, typical	
Test condition:	dropout time via the current-flow criterion, typical
Permissive tolerance/Limiting values:	± 15 ms + OOT
Test results/Remarks:	± 15 ms + OOT
1.35.5.2 Dropout time, via circuit-breaker auxiliary contact criterion	
Test condition:	dropout time, via circuit-breaker auxiliary contact criterion
Permissive tolerance/Limiting values:	± 5 ms + OOT

Summary

Test results/Remarks:	± 5 ms + OOT
1.35.6 Time delays	
Test condition:	added to the inherent operating times
Test values:	0.00 s to 60.00 s
Permissive tolerance/Limiting values:	± 1 % of setting value or 10 ms
Test results/Remarks:	± 1 % of setting value or 10 ms
1.35.7 Plausibility check	
1.35.7.1 3I0 criterion	
Test condition:	0.030 I _{rated} ≤ I _p ≤ 12.000 I _{rated}
Permissive tolerance/Limiting values:	± 2 % of setting value or 1 % I _{rated}
Test results/Remarks:	± 2 % or 1 % I _{rated}
1.35.7.2 I2 criterion	
Test condition:	0.030 I _{rated} ≤ I _p ≤ 12.000 I _{rated}
Permissive tolerance/Limiting values:	± 2 % of setting value or < 1 % I _{rated}
Test results/Remarks:	< 2 % or < 1 % I _{rated}
1.35.8 Operation with CB auxiliary contact	
Permissive tolerance/Limiting values:	function, not to manual
Test results/Remarks:	function correct

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Summary

1.36 Circuit Breaker Restrike Protection	
1.36.1 Pickup values	
Test condition:	0.030 I _{rated} ≤ I _p ≤ 35.000 I _{rated}
Test values:	f _{test} = 50 Hz, 60 Hz 0.030 I _{rated} ≤ I _p ≤ 35.000 I _{rated}
Permissive tolerance/Limiting values:	± 1 % of setting value or 0.5 % I _{rated}
Test results/Remarks:	± 1 % of setting value or 0.5 % I _{rated}
1.36.2 Dropout ratio	
Test condition:	see item 1.36.1
Test value:	95% of threshold value
Permissive tolerance/Limiting values:	± 1 % of setting value or 0.5 % I _{rated}
Test results/Remarks:	± 1 % of setting value or 0.5 % I _{rated}
1.36.3 Pickup times	
Test condition:	see item 1.36.1 1.2*threshold
Permissive tolerance/Limiting values:	t approx. 25 ms + OOT at 50 Hz 22 ms + OOT at 60 Hz
Test results/Remarks:	t approx. 25 ms + OOT at 50 Hz 22 ms + OOT at 60 Hz
1.36.4 Dropout times	
Test condition:	see item 1.36.1 1.2*threshold
Permissive tolerance/Limiting values:	20 ms + OOT
Test results/Remarks:	20 ms + OOT
1.36.6 Time delay T1 for 3-pole restrip	
Test condition:	see item 1.36.1 1.2*threshold
Test values:	0.00 s to 60.00 s
Permissive tolerance/Limiting values:	> 1 % of setting value or 10 ms
Test results/Remarks:	± 1 % of setting value or 10 ms

Summary

1.36.6	Time delay T2 for 3-pole trip
Test condition:	see item 1.36.1 1.2*threshold
Test values:	0.05 s to 60.00 s
Permissive tolerance/limiting values:	- 1 % of setting value or 10 ms
Test results/Remarks:	+ 1 % of setting value or 10 ms
1.36.7	Time delay for minimum operate
Test condition:	see item 1.36.1 1.2*threshold
Test values:	0.00 s to 60.00 s
Permissive tolerance/limiting values:	- 1 % of setting value or 10 ms
Test results/Remarks:	- 1 % of setting value or 10 ms
1.36.8	Time delay for dropout
Test condition:	see item 1.36.1 1.2*threshold
Test values:	0.00 s to 60.00 s
Permissive tolerance/limiting values:	- 1 % of setting value or 35 ms
Test results/Remarks:	- 1 % of setting value or 35 ms
1.36.9	Position recognition delay
Test condition:	see item 1.36.1 1.2*threshold
Test values:	0.00 s to 60.00 s
Permissive tolerance/limiting values:	- 1 % of setting value or 10 ms
Test results/Remarks:	- 1 % of setting value or 10 ms
1.36.10	Monitoring duration
Test condition:	see item 1.36.1 1.2*threshold
Test values:	1.00 s to 600.00 s
Permissive tolerance/limiting values:	- 1 % of setting value or 10 ms
Test results/Remarks:	- 1 % of setting value or 10 ms

Summary

1.37	67N Restricted Earth Fault Protection (67N)
1.37.1	Specifications
-	VDE 4435 IEC/EN 60255-1, Item 7, Annex A, B
1.37.2	Pickup value (I_{set})
Test condition:	0.05 * I _{set} * A _{pick-CO} = 2.00
Test values:	0.05 * I _{set} * A _{pick-CO} = 2.00 f _{test} = 50 Hz, 60 Hz
Permissive tolerance/limiting values:	N < 2 % of setting value at I < 5 I _{nom}
Test results/Remarks:	N < 2 % of setting value at I < 5 I _{nom}
1.37.3	Pickup times (t_{pick})
1.37.3.1	1.5 x setting value (I_{set})
Test condition:	IEC/EN 60255-1
Test values:	1.5 x setting value I _{set} f _{test} = 50 Hz, 60 Hz
Permissive tolerance/limiting values:	t approx: 35 ms + OOT at f _{test} = 50 Hz 37 ms + OOT at f _{test} = 60 Hz
Test results/Remarks:	t < 35 ms + OOT at f _{test} = 50 Hz < 32 ms + OOT at f _{test} = 60 Hz
1.37.3.2	2.5 x setting value (I_{set})
Test condition:	see item 1.37.3.1
Test values:	2.5 x setting value I _{set} f _{test} = 50 Hz, 60 Hz
Permissive tolerance/limiting values:	t approx: 27 ms + OOT at f _{test} = 50 Hz 28 ms + OOT at f _{test} = 60 Hz
Test results/Remarks:	t < 27 ms + OOT at f _{test} = 50 Hz < 26 ms + OOT at f _{test} = 60 Hz
1.37.3.3	Dropout times
Test condition:	see item 1.37.3.1
Test values:	see item 1.37.3.1
Permissive tolerance/limiting values:	t approx: 60 ms at f _{test} = 50 Hz 67 ms at f _{test} = 60 Hz

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Test results/Remarks:	t < 80 ms at f _{test} = 50 Hz < 67 ms at f _{test} = 60 Hz
1.37.3.4	Time delays
Test condition:	added to the inherent operating times
Test values:	0.00 s - T ₀ - 60.00 s, +
Permissive tolerance/limiting values:	N < 1 % of setting value or 10 ms
Test results/Remarks:	N < 1 % of setting value or 10 ms
1.37.3.5	Dropout ratio (I_{dr})
Test condition:	see item 1.37.3.1
Test values:	see item 1.37.3.1
Permissive tolerance/limiting values:	r approx. 0.70
Test results/Remarks:	0.68 - r - 0.72

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Summary

1.39 79 Automatic Reclosing Function
Permissive tolerance/Limiting values: Funct. acc. to manual
Test results/Remarks: Function correct

Summary

1.40 Fault Locator
1.40.1 Specifications
- VDE 6435
- IEC/EN 60255-1, Item 7, Annex A, B
1.40.2 Distance-to-fault measuring (FOR)
Test condition: Measuring tolerances for sinusoidal values and fault duration > 25 ms
Permissive tolerance/Limiting values: ± 2.0 % of fault location (without intermediate inflect)
Test results/Remarks: < 2.0 %
1.40.3 Start-to-measure command
Test condition: - by trip signal
- by drop-off of pickup
Permissive tolerance/Limiting values: function according to manual
Test results/Remarks: function correct



Summary

1.41 Temperature Supervision
1.41.1 Pickup values
Test condition: -50 °C to 250 °C
-58 °F to 482 °F
Permissive tolerance/Limiting values: ±0.5 % of the setting value or ±1 °C or ±2 °F
Test results/Remarks: ±0.5 % of the setting value or ±1 °C or ±2 °F
1.41.2 Dropout ratio
Test condition: -50 °C to 250 °C
-58 °F to 482 °F
Permissive tolerance/Limiting values: 3 °C or 6 °F
Test results/Remarks: 3 °C or 6 °F
1.41.3 Time delays
Permissive tolerance/Limiting values: 0.00 s to 60.00 s
Permissive tolerance/Limiting values: ± 1 % of setting value or 10 ms
Test results/Remarks: ± 1 % or 10 ms

Summary

1.42 Thermoboxes for Temperature Detection
1.42.1 Specifications
- IEC/EN 60255-1
1.42.2 Connection
- Ethernet: TR1200 IP
- RS 485: TR1200
1.42.3 Temperature detectors
Test condition: Connectable Thermoboxes 4
Test values: Number of Thermoboxes per type 4
Test results/Remarks: numbers correct
1.42.4 Number of temperature sensors per thermobox
Test condition: Max. 12
Test values: Max. 12
Test results/Remarks: numbers correct
1.42.5 Thresholds for indication stage 1
Test condition: -50 °C to 250 °C
-58 °F to 482 °F
Test values: -50 °C to 250 °C
-58 °F to 482 °F
Permissive tolerance/Limiting values: ± 1% of setting value or ± 1 °C or ± 2 °F
Test results/Remarks: ± 1% of setting value or ± 1 °C or ± 2 °F
1.42.6 Thresholds for indication stage 2
Test condition: -50 °C to 250 °C
-58 °F to 482 °F
Test values: -50 °C to 250 °C
-58 °F to 482 °F
Permissive tolerance/Limiting values: ± 1% of setting value or ± 1 °C or ± 2 °F
Test results/Remarks: ± 1% of setting value or ± 1 °C or ± 2 °F
1.42.7 Dropout ratio
Test condition: 3 °C or 6 °F

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Summary

Test values: 3 °C or 6 °F
Test results/Remarks: Function correct
1.42.8 Time delays
Test condition: Added to the Inherent Operating Times
Test values: 0,00 s to 60,00 s or =
Permissive tolerance/limiting values: ± 1 % of setting value or 10 ms
Test results/Remarks: ± 1 % of setting value or 10 ms

Summary

1.43 Jump Detection
1.43.1 Current jump detection
1.43.1.1 Pickup values
Test condition: L-N, 30
 $I_{pickup} = 60 \text{ Hz}, 60 \text{ Hz}$
 $0,030 I_{rated} > I > 35,000 I_{rated}$
Permissive tolerance/limiting values: $\pm 3 \% \text{ of setting value or } 0,01 I_{rated}$
Test results/Remarks: $\pm 3 \% \text{ of setting value or } 0,01 I_{rated}$
1.43.1.2 Pickup times
Test condition: see item 1.43.1.1
Test values: see item 1.43.1.1
Permissive tolerance/limiting values: t approx.
8 ms + OOT
Test results/Remarks: t approx.
8 ms + OOT
1.43.2 Voltage jump detection
1.43.2.1 Pickup values
Test condition: L-N, L-L, V0
 $I_{pickup} = 60 \text{ Hz}, 60 \text{ Hz}$
 $0,30V \geq V > 340,000 \text{ V}$
Permissive tolerance/limiting values: $\pm 2 \% \text{ of setting value or } 0,1 \text{ V}$
Test results/Remarks: $\pm 2 \% \text{ of setting value or } 0,1 \text{ V}$
1.43.2.2 Pickup times
Test condition: see item 1.43.2.1
Test values: see item 1.43.2.1
Permissive tolerance/limiting values: t approx.
8 ms + OOT
Test results/Remarks: t approx.
8 ms + OOT

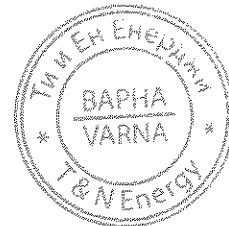
Summary

1.44 25 Synchronization Function
1.44.1 Tolerances
1.44.1.1 Tolerances of the voltage settings
Permissive tolerance/limiting values: 2 % of setting value or 1 V
Test results/Remarks: Confirmed
1.44.1.2 Voltage difference $V2 > V1; V2 < V1$
Permissive tolerance/limiting values: 1 V
Test results/Remarks: ± 0,15 V
1.44.1.3 Frequency difference $f2 > f1; f2 < f1$
Permissive tolerance/limiting values: 1 mHz
Test results/Remarks: ± 1mHz
1.44.1.4 Angular difference $\alpha2 > \alpha1; \alpha2 < \alpha1$
Permissive tolerance/limiting values: 1 °
Test results/Remarks: ± 0,2 °
1.44.1.5 Tolerance of all time settings
Permissive tolerance/limiting values: 10 ms
Test results/Remarks: ± 10 ms
1.44.1.6 Max. phase displacement angle
Permissive tolerance/limiting values: 5 ° for $\Delta f \leq 1 \text{ Hz}$
10 ° for $\Delta f > 1 \text{ Hz}$
Test results/Remarks: $\leq 5 ° \text{ for } \Delta f \leq 1 \text{ Hz}$
 $\leq 10 ° \text{ for } \Delta f > 1 \text{ Hz}$
1.44.2 Tested functionality
Test values: Synchronous operation mode
Asynchronous operation mode
De-energized switching
Dead line
Dead bus
DDI limitation
Low frequent oscillations
Direct closing
Function values
Error reactions
Threshold values for
- Voltages and voltage difference
- Frequency and frequency difference
- Angle difference
- Rate of frequency change

Summary

- Delay time
Binary inputs
- Start and stop
- Selection
- Blocking
- De-energized switching
Start synchronization by
- Control function
- Auto recloser
- Binary input
Conditions
- Connection types Ph-Ph and Ph-Gnd
- 3ph and 1ph measuring points
- V sync Selection by measuring point ID
Test results/Remarks: Functionality according to manual confirmed

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Summary

1.46	80V Voltage Control
1.45.1	Specifications
-	VDE 0435
-	IEC/EN 60255-1, item 7, Annex A, B
1.45.2	General Test conditions
Rated:	80 Hz, 80 Hz
Instr:	1 A, 5 A
Vrated:	100 V
1.45.3	Voltage Control
1.45.3.1	Target Voltage
Test condition:	10.000 V ± Vtarget ≤ 340.000 V
Permissible tolerance/limiting values:	δ ≤ 0.5 % of setting value or 0.05 V
Test results/Remarks:	δ < 0.5 % of setting value or 0.05 V
1.45.3.2	Bandwidth
Test condition:	0.2 % to 10.0 %
Test results/Remarks:	confirmed
1.45.4	Line compensation LDC-Z
1.45.4.1	Target voltage rising
Test condition:	0.0 % to 20.0 %
Test results/Remarks:	confirmed
1.45.4.2	Max load current
Test condition:	0.0 % to 800.0 %
Test results/Remarks:	confirmed
1.45.5	Line compensation LDC-X and R
1.45.5.1	R line
Test condition:	0.0 Ω to 30.0 Ω
Test results/Remarks:	confirmed
1.45.5.2	X line
Test condition:	-30.0 Ω to 30.0 Ω
Test results/Remarks:	confirmed

Summary

1.45.6	Limiting
1.45.6.1	Vmin Threshold
Test condition:	10.000 V - Vmin - 340.000 V
Permissible tolerance/limiting values:	δ ≤ 0.5 % of setting value or 0.05 V
Test results/Remarks:	δ < 0.6 % of setting value or 0.05 V
1.45.6.2	Vmax Threshold
Test condition:	10.000 V - Vmax - 340.000 V
Permissible tolerance/limiting values:	δ ≤ 0.5 % of setting value or 0.05 V
Test results/Remarks:	δ < 0.5 % of setting value or 0.05 V
1.45.6.3	Vmin Time delay
Test condition:	added to the inherent operating times
Test values:	0 s - T - 20 s
Permissible tolerance/limiting values:	δ ≤ 1 % of setting value or 10 ms
Test results/Remarks:	δ < 1 % or 10 ms
1.45.6.4	Vmax Time delay
Test condition:	added to the inherent operating times
Test values:	0 s - T - 20 s
Permissible tolerance/limiting values:	δ ≤ 1 % of setting value or 10 ms
Test results/Remarks:	δ < 1 % or 10 ms
1.45.7	Blockings
1.45.7.1	V< Threshold
Test condition:	10.000 V - Vmin - 340.000 V
Permissible tolerance/limiting values:	δ ≤ 0.5 % of setting value or 0.05 V
Test results/Remarks:	δ < 0.5 % of setting value or 0.05 V
1.45.7.2	V> Threshold
Test condition:	10 % ≤ δ ≤ 500 %
Test results/Remarks:	confirmed

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1.45.7.3	V< Threshold
Test condition:	3 % ≤ δ ≤ 100 %
Test results/Remarks:	confirmed
1.45.7.4	V< Time delay
Test condition:	added to the inherent operating times
Test values:	0 s - T - 20 s
Permissible tolerance/limiting values:	δ ≤ 1 % of setting value or 10 ms
Test results/Remarks:	δ < 1 % or 10 ms
1.45.7.5	V> Time delay
Test condition:	added to the inherent operating times
Test values:	0 s - T - 20 s
Permissible tolerance/limiting values:	δ ≤ 1 % of setting value or 10 ms
Test results/Remarks:	δ < 1 % or 10 ms
1.45.7.6	V< Time delay
Test condition:	added to the inherent operating times
Test values:	0 s - T - 20 s
Permissible tolerance/limiting values:	δ ≤ 1 % of setting value or 10 ms
Test results/Remarks:	δ < 1 % or 10 ms



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1.46	Supervision Functions
1.45.1	Voltage-transformer circuit breaker
Permissible tolerance/limiting values:	funct. acc. to manual
Test results/Remarks:	Function correct
1.45.2	Current-balance supervision
Permissible tolerance/limiting values:	funct. acc. to manual
Test results/Remarks:	Function correct
1.45.3	Voltage-balance supervision
Permissible tolerance/limiting values:	funct. acc. to manual
Test results/Remarks:	Function correct
1.45.4	Current-sum supervision
Permissible tolerance/limiting values:	funct. acc. to manual
Test results/Remarks:	Function correct
1.45.5	Voltage-sum supervision
Permissible tolerance/limiting values:	funct. acc. to manual
Test results/Remarks:	Function correct
1.45.6	Measuring-voltage failure (Fuse failure monitor)
Permissible tolerance/limiting values:	funct. acc. to manual
Test results/Remarks:	Function correct
1.45.7	Current phase rotation supervision
Permissible tolerance/limiting values:	funct. acc. to manual
Test results/Remarks:	Function correct
1.45.8	Voltage phase rotation supervision
Permissible tolerance/limiting values:	funct. acc. to manual
Test results/Remarks:	Function correct
1.45.9	747C Trip circuit supervision
Test condition:	Number trip circuit: 1 to 3 Operation mode: with 1 or 2 B)

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Summary

Permissible tolerance/limiting values: funct. acc. to manual
Test results/Remarks: Function correct

Summary

1.47 Operational Measured Values

1.47.1 Specifications

- IEC/EN 60255-1, Annex A, B

1.47.2 Currents, instrument transformers

Test condition: Current range < 1.8 I_{rated}
Nominal range 1 A, 5 A
Measuring ranges (0.1 to 1.6) I_{rated}
Frequency range:
I_{rated} = 50 Hz: 49 Hz to 51 Hz
I_{rated} = 60 Hz: 59 Hz to 61 Hz

Test values: IA, IB, IC, 3I0 in A (prim), A (sec), % (of I_{rated})

Permissible tolerance/limiting values: $\pm 0.1\%$ of the measured value in the above mentioned ranges

Test results/Remarks: $\pm 0.1\%$

Test condition: Frequency range:
I_{rated} = 50 Hz: 40 Hz to 60 Hz
I_{rated} = 60 Hz: 50 Hz to 70 Hz

Test values: IA, IB, IC, 3I0 in A (prim), A (sec), % (of I_{rated})

Permissible tolerance/limiting values: $\pm 0.3\%$ of the measured value in the above mentioned ranges

Test results/Remarks: $\pm 0.3\%$

1.47.3 Currents, protection-class transformers

Test condition: Current range < 100 I_{rated}¹, < 50 I_{rated}²
Nominal range 1 A, 5 A
Measuring ranges 0.1 to 25 A
Frequency range:
I_{rated} = 50 Hz: 49 Hz to 51 Hz
I_{rated} = 60 Hz: 59 Hz to 61 Hz

Test values: IA, IB, IC, 3I0 in A (prim), A (sec), % (of I_{rated})

Permissible tolerance/limiting values: $\pm 0.1\%$ of the measured value in the above mentioned ranges

Test results/Remarks: $\pm 0.1\%$ of the measured value

Test condition: Frequency range:
I_{rated} = 50 Hz: 40 Hz to 60 Hz
I_{rated} = 60 Hz: 50 Hz to 70 Hz

¹ for modular device only
² for non-modular device only

Summary

Test values: IA, IB, IC, 3I0 in A (prim), A (sec), % (of I_{rated})
Permissible tolerance/limiting values: $\pm 0.3\%$ of the measured value in the above mentioned ranges
Test results/Remarks: $\pm 0.3\%$

1.47.4 Voltages

Test condition: Voltage Range < 200 V (sec.)
Secondary rated voltage 100 V to 125 V
Measuring Range (1.1 to 2) V_{rated}

Frequency range:
I_{rated} = 50 Hz: 49 Hz to 51 Hz
I_{rated} = 60 Hz: 59 Hz to 61 Hz

Test values: VA, VB, VC, VAB, VBC, VCA in kV (prim), in V (sec), % of V_{rated}

Permissible tolerance/limiting values: 0.1 % of the measured value in the above mentioned ranges

Test results/Remarks: $\pm 0.1\%$

Test condition: Frequency range:
I_{rated} = 50 Hz: 40 Hz to 60 Hz
I_{rated} = 60 Hz: 50 Hz to 70 Hz

Test values: VA, VB, VC, VAB, VBC, VCA in kV (prim), in V (sec), % of V_{rated}

Permissible tolerance/limiting values: 0.3 % of the measured value in the above mentioned ranges

Test results/Remarks: $\pm 0.3\%$

1.47.5 Phase angle, current and voltage

Test condition: I_{rated}, V_{rated}
Frequency range:
I_{rated} = 50 Hz: 47.5 Hz to 52.5 Hz
I_{rated} = 60 Hz: 57.5 Hz to 62.5 Hz
(operative range 10 Hz to 60 Hz with higher tolerances)

Test values: φ (IA-IB), φ (IB-IC), φ (IC-IA) in °
 φ (VA-VB), φ (VB-VC), φ (VC-VA) in °

Permissible tolerance/limiting values: Current $\pm 0.2^\circ$ at I_{rated}
Voltage $\pm 0.2^\circ$ at V_{rated}

Test results/Remarks: Current < 0.2 ° at I_{rated}
Voltage < 0.2 ° at V_{rated}

1.47.6 Power, ratings
1.47.6.1 Active Power P

Test condition: W secondary

Summary

Measuring Range: $|\cos \varphi| \geq 0.01$
Voltage Range: (0.8 to 1.2) V_{rated}
Current range: (0.1 to 2) I_{rated}
Frequency range:
I_{rated} = 50 Hz: 49 Hz to 51 Hz
I_{rated} = 60 Hz: 59 Hz to 61 Hz

Test values: P, PA, PB, PC in W (secondary)

Permissible tolerance/limiting values: $\pm 0.3\%$ of the measured value in the above mentioned ranges

Test results/Remarks: $\pm 0.3\%$

Test condition: Frequency range:
I_{rated} = 50 Hz: 40 Hz to 60 Hz
I_{rated} = 60 Hz: 50 Hz to 70 Hz

Test values: P, PA, PB, PC in W (secondary)

Permissible tolerance/limiting values: $\pm 0.5\%$ of the measured value in the above mentioned ranges

Test results/Remarks: $\pm 0.5\%$



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Summary

1.47.8.2 Reactive Power Q

Test condition: VAr secondary

Measuring Range: $|cos \phi| \geq 0.994$

Voltage Range: (0.8 to 1.2) Vrated

Current range: (0.1 to 2) Irated

Frequency range:
Irated = 50 Hz: 49 Hz to 51 Hz
Irated = 60 Hz: 59 Hz to 61 Hz

Test values: Q, QA, QB, QC in VAr (secondary)

Permissible tolerance/Limiting values: $\pm 1\%$ of the measured value in the above mentioned ranges

Test results/Remarks: $\pm 1\%$

Test values: Q, QA, QB, QC in VAr (secondary)

Permissible tolerance/Limiting values: $\pm 1.5\%$ of the measured value in the above mentioned ranges

Test results/Remarks: $\pm 1.5\%$

1.47.8.3 Apparent Power S

Test condition: VA secondary

Measuring Range: (0.01 to 2) Srated

Voltage Range: (0.8 to 1.2) Vrated

Current range: (0.1 to 2) Irated

Frequency range:
Irated = 50 Hz: 49 Hz to 51 Hz
Irated = 60 Hz: 59 Hz to 61 Hz

Test values: S, SA, SB, SC in VA (secondary)

Permissible tolerance/Limiting values: $\pm 0.3\%$ of the measured value in the above mentioned ranges

Test results/Remarks: $\pm 0.3\%$

Test condition: Frequency range:
Irated = 50 Hz: 49 Hz to 51 Hz
Irated = 60 Hz: 59 Hz to 61 Hz

Test values: S, SA, SB, SC in VA (secondary)

Permissible tolerance/Limiting values: $\pm 0.5\%$ of the measured value in the above mentioned ranges

Summary

1.48 CB wear monitoring

1.48.1 Zk-method
No accuracies defined, because this method is a monitoring function, which contains no protection-specific task and the principles are based upon empiric determined data.

1.48.2 2P-method
No accuracies defined, because this method is a monitoring function, which contains no protection-specific task and the principles are based upon empiric determined data.

1.48.3 IZ-method
No accuracies defined, because this method is a monitoring function, which contains no protection-specific task and the principles are based upon empiric determined data.

1.48.4 Supv.CB make time
1.48.4.1 Circuit breaker closing time

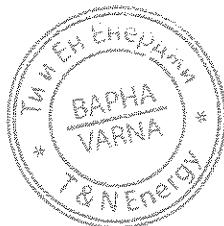
Test condition/Operative range: Irated = 50 Hz, 60Hz
0.001 s ... ICBctm ... 0.600 s

Test values: 0.03 A \leq I \leq 5 A

Permissible tolerance/Limiting values: ICBctm \leq 2 ms

Test results/Remarks: ICBctm $<$ 2 ms

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ОРИГИНАЛТА



Summary

Test results/Remarks: $\pm 0.5\%$

1.47.7 Frequency

Test condition: Frequency range 10 Hz to 80 Hz

Test values: f in Hz and Irated

Permissible tolerance/Limiting values: ± 20 mHz in the range (Irated $\pm 10\%$ at Vrated, Irated)

Test results/Remarks: ± 10 mHz in the range (Irated $\pm 10\%$ at Vrated, Irated) (operative range $>$ Irated $\pm 10\%$ with higher tolerances)

Summary

1.49 Ancillary Functions

1.49.1 Log buffers

1.49.1.1 Operational log
Permissible tolerance/Limiting values: Funct. acc. to manual

Test results/Remarks: Function correct

1.49.1.2 Fault log
Permissible tolerance/Limiting values: Funct. acc. to manual

Test results/Remarks: Function correct. Not applicable for Fault Recorder 7KE85.

1.49.1.3 Ground fault log
Permissible tolerance/Limiting values: Funct. acc. to manual

Test results/Remarks: Function correct. Not applicable for Fault Recorder 7KE85.

1.49.2 Fault recording
Permissible tolerance/Limiting values: Funct. acc. to manual

Test results/Remarks: Function correct

1.49.3 Date and time
Permissible tolerance/Limiting values: Funct. acc. to manual

Test results/Remarks: Function correct

1.49.4 Setting group switching
Permissible tolerance/Limiting values: Funct. acc. to manual

Test results/Remarks: Function correct. Not applicable for Fault Recorder 7KE85.

1.49.5 Test functions

1.49.5.1 CB tripping test
Test condition: Live tripping of CB

Permissible tolerance/Limiting values: Funct. acc. to manual

Test results/Remarks: Function correct. Not applicable for Fault Recorder 7KE85.

1.49.5.2 Test record
Permissible tolerance/Limiting values: Funct. acc. to manual

Test results/Remarks: Function correct

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Summary

1.50 Interfaces

1.50.1 USB Interface (front panel)

Permissive tolerance/limiting values: Funct. acc. to manual

Test results/Remarks: Function correct

1.50.2 Integrated ethernet interface (rear)

Permissive tolerance/limiting values: Funct. acc. to manual

Test results/Remarks: Function correct

1.50.3 System interfaces

1.50.3.1 IEC 60870-5-103

Test values: RS232, RS485, LWL

Permissive tolerance/limiting values: Funct. acc. to manual

Test results/Remarks: Function correct

1.50.3.2 IEC 60870-5-104

Permissive tolerance/limiting values: Funct. acc. to manual

Test results/Remarks: Function correct

1.50.3.3 DNP3.0

Test values: RS485, LWL

Permissive tolerance/limiting values: Funct. acc. to manual

Test results/Remarks: Function correct

1.50.3.4 IEC 61850

Permissive tolerance/limiting values: Funct. acc. to manual

Test results/Remarks: Function correct

1.50.4 Time synchronization

Test condition: IRIG-B, DCF77, SNTP

Permissive tolerance/limiting values: Funct. acc. to manual

Test results/Remarks: Function correct

1.50.5 Protection interfaces

Test values: Flush-mount housing
Surface-mounting housing

Summary

Permissive tolerance/limiting values: Funct. acc. to manual

Test results/Remarks: Function correct

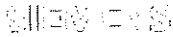
1.50.6 Phasor measurement unit (PMU)

Permissive tolerance/limiting values: Accuracy according to IEEE STD C37.118.1 (class P)
Accuracy according to IEEE STD C37.118.1 (class M)

Test results/Remarks: Function correct

ВЯРНО С
ОРИГИНАЛА





Test Report

Test Report No.: TS0716-001
Date of issue: 2016-07-15

Subject:

Type test Overcurrent Protection SIPROTEC 5 - V07.30 / Edition 08

The tests were performed by:

SIEMENS AG
Development
EM DG PRO D
Wernerwerkdam 5
D - 13629 Berlin

The tests were performed for:

SIEMENS AG
Products
EM DG PRO LM
Humboldtstr. 59
D - 90459 Nürnberg

This test report consists of 174 pages.

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Template: TTR_TMP.doc

A53000-G7310-T013-01-70A1

Version: 2.01

Scope of protocol

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Tested equipment Multifunction Protection Relays SIPROTEC 5

Product group: Overcurrent Protection
7SJ82, 7SJ85

Firmware V07.30

Tests are according to: IEC/EN 60255 series, VDE 0435, IEC/EN 60870-2-1,
IEC/EN 61000-6-2/4, IEEE Std C37.90.1/2, UL 508

Performed tests: Properties at reference conditions

Test results: The equipment has successfully passed the type test. The equipment did not show any changes and was fully in order subsequent to these tests.

SIEMENS AG - EM DG PRO
Division Energy Management
Digital Grid

Place: EM DG PRO D
13629 Berlin (Siemensstadt)

Date: 2016-07-15

Tested by: Wang, Lu

Wang Lu.
Signature



Reviewed by: Rochow, Norbert

Signature

ВЯРИО С
ОРИГИНАЛА



Range of validity

SIPROTEC 5 Platform and Hardware Characteristics

The SIPROTEC 5 series includes both modular and non-modular devices.
Modular devices consist of a base module (1/3 of 19 inches) and can be expanded with expansion modules (1/6 of 19 inches). The device type identifier for modular devices is XXX85, XXX86 or XXX87, for example, 7SA86 Type XXX84 devices have the same hardware properties as the modular devices, but they cannot be expanded with expansion modules.

All non-modular devices consist of just a base module (1/3 of 19 inches) and cannot be expanded with expansion modules (1/6 of 19 inches). The device type identifier for non-modular devices is 7XX82, e.g., 7SJ82.

Hardware Characteristics of Modular Devices

A modular device always consists of a base module and optionally of expansion modules. The modules can be chosen according to hardware characteristics. These characteristics are:

- Module size
- Type of construction
- Mounting of the on-site operation panel
- Layout (or design) of the on-site operation panel
- Input and output module
- Plug-in modules

The modules are available in 2 sizes:

- Base module (1/3 of 19 in)
- Extension module (1/6 of 19 in)

The devices are available in 3 designs:

- Flush-mounting devices with on-site operation panel fitted directly on the device
- Surface-mounting devices with integrated on-site operation panel
- Surface-mounting devices with detached on-site operation panel

The on-site operation panels of the base modules can be selected from 3 variants:

- With a large display, keypad, and 16 2-colored LEDs
- With a small display, keypad, and 16 2-colored LEDs
- Without a display, without a keypad, but with 16 2-colored LEDs

The on-site operation panels of the extension modules can be selected from 4 variants:

- With 16 1-colored LEDs and 2 key switches
- With 16 1-colored LEDs
- With 8 push-buttons and 8 1-colored LEDs
- Without display elements

The base module always contains the power-supply module PS201 and an input and output module IO2XX.
The extension module contains an input and output module IO2XX or a plug-in module assembly with integrated power supply CB202.

The 1st extension module in the 2nd device row always contains power supply module PS203.

The plug-in modules are available for various applications. The following plug-in modules can be installed in the base module or in an extension module with plug-in module assembly with integrated power supply CB202:

- Communication module
- Measuring-transducer module

Range of validity

Hardware Characteristics of Non-Modular Devices

A non-modular device always consists of just one module (1/3 of 19 inches) and cannot be expanded with expansion modules (1/6 of 19 inches). These hardware characteristics are:

- Module size: 1/3 of 19 in.
- Type of construction: Flush-mounting devices with on-site operation panel fitted directly on the device

The on-site operation panels can be chosen from 2 variants:

- With a large display, keypad, and 16 2-colored LEDs
- With a small display, keypad, and 16 2-colored LEDs

The module always contains the power supply module PS101 and an input and output module IO10X. The input and output module IO10X includes the terminals for current and voltage transformers. Optionally, the module can be equipped an additional input and output module IO110 for extra binary inputs and outputs. The plug-in modules are available for various applications. The following plug-in modules can be installed in the module:

- Communication modules
- Measuring-transducer modules

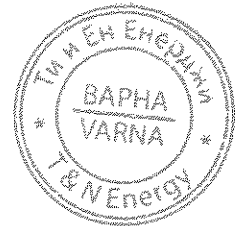
Range of validity

SIPROTEC 5 devices

All type tests were performed at various combinations of all modules of the SIPROTEC 5 platform. As a result the following devices were covered:

Model of Protective Relay	Trip Detection	Quantity structure
7SJ85 Overcurrent Protection	3-pole trip	I/Os fully modular
7SJ82 Overcurrent Protection	3-pole trip	I/Os not extendable

ВЯРНО С
ОРИГИНАЛ



Range of validity

SIPROTEC 5, functional description of power supply, CPU, IO boards and plug-in modules
All hardware type tests were performed at various combinations with all modules of the SIPROTEC 5 platform.
As a result all realized devices were covered:

SIPROTEC 5
Functional description of boards for modular devices

Board name	Functional description
PS201	Power Supply Board (DC: 24 V/48 V or 60 V to 250 V and AC: 100 V to 230 V), mounted in 1/3 19-inch size housing, including 3 binary inputs, 2 binary outputs and one status life contact
PS203	Power Supply Board for the 2nd row of devices, (DC: 24 V/48 V or 60 V to 250 V and AC: 100 V to 230 V), mounted in 1/6 19-inch size housing
CB202	Plug-in module assembly, including an additional power supply, (DC: 24 V/48 V or 60 V to 250 V and AC: 100 V to 230 V), mounted in 1/6 19-inch size housing
CP200/CP300	Processor (CPU) Board, mounted into the front cover of the 1/3 19-inch size housing, different variants for the available device designs
IO201	Input Output Board, 4 current inputs, 6 binary inputs, 6 binary outputs, reduced assembled variant of IO202
IO202	Input Output Board, 4 current measuring inputs, 4 voltage measuring inputs, 8 binary inputs, 6 binary outputs, mounted in 1/6 or 1/3 19-inch size housing
IO203	Input Output Board, 8 current measuring inputs, 4 binary inputs, 4 binary outputs, mounted in 1/6 19-inch size housing
IO204	Input Output Board, 10 binary inputs, 4 binary outputs, 4 power relays for controlling 2 motors, mounted in 1/6 19-inch size housing
IO205	Input Output Board, 12 binary inputs, 16 binary outputs, mounted in 1/6 19-inch size housing
IO206	Input Output Board, 6 binary inputs, 7 binary outputs, mounted in 1/6 19-inch size housing, reduced assembled variant of IO205
IO207	Input Output Board, 18 binary inputs, 8 binary outputs, mounted in 1/6 19-inch size housing
IO208	Input Output Board, 4 current measuring inputs, 4 voltage measuring inputs, 4 binary inputs, 11 binary outputs, mounted in 1/3 or 1/6 19-inch size housing
IO209	Input Output Board, 8 binary inputs, 4 High Speed Outputs, mounted in 1/6 19-inch size housing
IO210	Input Output Board, 4 current measuring inputs, 3 voltage measuring inputs, 7 binary outputs, 4 high-speed measuring-transducer inputs for current or voltage, mounted in 1/6 19-inch size housing
IO211	Input Output Board, 8 voltage measuring inputs, 8 binary inputs, mounted in 1/6 or 1/3 19-inch size housing
IO212	Input Output Board, 8 high-speed measuring-transducer inputs for current or voltage, 8 binary inputs, mounted in 1/6 19-inch size housing
IO214	Input Output Board, 4 current measuring inputs, 4 voltage measuring inputs, 2 binary in-puts, 5 binary outputs, mounted in 1/6 or 1/3 19-inch size housing, reduced assembled variant of IO202
IO215	Input Output Board, 4 current measuring inputs, 4 voltage measuring inputs (designed for a measuring range up to 7.07 V) 8 binary inputs, 6 binary outputs, mounted in 1/6 or 1/3 19-inch size housing
IO230	Input Board, 48 binary inputs, mounted in 1/6 19-inch size housing
IO231	Input Output Board, 24 binary inputs, 24 binary outputs, mounted in 1/6 19-inch size housing
PB201	Process-Bus Module, 7 LC Duplex interfaces of which one is a service port,

Range of validity

mounted in 1/6 19-inch size housing

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Range of validity

Functional description of boards for non-modular devices

Board name	Functional description
PS101	Power Supply Board (DC: 24 V/48 V or DC: 60 V to 125 V or DC: 110 V to 250 V and AC: 100 V to 230 V), including 3 binary inputs, 2 binary outputs and one status life contact
IO101	Input Output Board, 4 current inputs, 8 binary inputs, 6 binary outputs, reduced assembled variant of IO102
IO102	Input Output Board, 4 current inputs, 4 voltage inputs, 6 binary inputs, 6 binary outputs
IO103	Input Output Board, 8 current inputs, 4 binary inputs, 4 binary outputs
IO110	Input Output Board, 12 binary inputs, 7 binary outputs
CP100	Processor (CPU) Board, mounted into the front cover of the device

Functional description of plug-in modules for modular devices and for non-modular devices

USART-xx ¹ -y ² EL	Serial communication module, electrical connection
USART-xx ¹ -y ² F0	Serial communication module, optical connection
USART-xx ¹ -y ² LDFO	Serial communication module for long distances, optical connection
ETH-xx ¹ -2EL	Ethernet module, electrical connection
ETH-xx ¹ -2F0	Ethernet module, optical connection
ANAI-CA-4EL	Measuring-transducer module
ARC-CD-3F0 ³	Arc Protection module

Valid for all firmware and DIGSI versions.

¹ xx: two letters, unique code for the module in the product code of the device
² y: 1 = 1 channel;
2 = 2 channels
³ Not available for Busbar Protection and Fault Recorder

Scope of editions

Edition	Date	Modifications or supplements compared to the former edition
01	2012-12-03	First Edition, Software V02.00
02	2012-03-21	Revision and extended at Software V03.00
03	2013-12-05	Revision and extended at Software V04.00
04	2014-05-27	Revision and extended at Software V05.00
05	2014-12-19	Revision and extended at Software V06.00
06	2015-04-07	Revision and extended at Software V06.20
07	2015-12-18	Revision and extended at Software V07.00
08	2016-07-15	Revision and extended at Software V07.30



Subcontracting

Testing laboratory

Marking

Technical information; Technical Data

Technical Information; Description:

Manual		Edition
1.	SIPROTEC 5 Protection Devices Product information	German English
	Part No. C53000-B5000-C001-B C53000-B5040-C001-B	
2.	SIPROTEC 5 Hardware Manual	German English
	Part No. C53000-G5000-C002-B C53000-G5040-C002-B	
3.	SIPROTEC 5 Operating Manual	German English
	Part No. C53000-G5000-C003-7 C53000-G5040-C003-7	
4.	SIPROTEC 5 Overcurrent Protection 7SJ85, 7SJ82 Manual	German English
	Part No. C53000-G5000-C017-7 C53000-G5040-C017-7	

For the Technical Data see the description (Technical Information).

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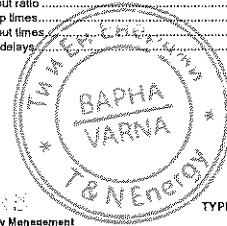
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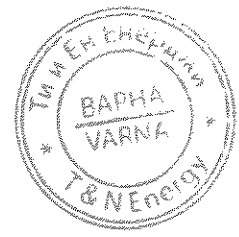
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Summary

Item	Test	Sheet
1	Properties at reference conditions	
1.1	General	
1.1.1	Standards	
For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.		
1.1.2	Time specifications and measurings	
If not otherwise declared, all specifications/results of pickup/tripping/reset times refer to the output of signals via test output relays (Type F).		
BO = Binary output		
Binary outputs: Number and data acc. to the order variant, see also general diagrams of devices		
1.1.3	Relay operating times	
Switching time (OOT) OOT (Output Operating Time): additional delay of the output medium used		
Type S =	standard relay	OOT: Closing time: average: 8 ms; maximum: < 10 ms; Opening time: average: 2 ms; maximum: < 5 ms;
Type F =	fast relay	OOT: Closing time: average: 4 ms Opening time: average: 2 ms Maximum: < 5 ms
Type HS =	High-Speed Relay	OOT: Closing time: average: 1 ms; Opening time: average: 8 ms; maximum: < 0 ms;

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ВЕРНО С
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Summary

1.2 50/51 Overcurrent Protection, Phases

1.2.1 Specifications

- VDE 0438
- IEC/EN 60255-1, Item 7, Annex A, B
- IEC/EN 60255-181

1.2.2 Overcurrent Protection, phases with definite time overcurrent stage (definite time)

1.2.2.1 Pickup values

Test condition: $0.030 I_{pmax}$ (threshold value) - $35.000 I_{pset}$
 $f_{test} = 50 \text{ Hz}, 60 \text{ Hz}$

Method of measurement = fundamental components of phases:

Permissive tolerance/Limiting values: 1 % of setting value or $0.005 I_{pset}$

Test results/Remarks: 1 % of setting value or $0.005 I_{pset}$

Method of measurement = RMS value of phases, no filter applied:

Permissive tolerance/Limiting values: up to 30th harmonic: 1 % of setting value or $0.005 I_{pset}$
up to 50th harmonic, $f_{test} = 50 \text{ Hz}$: 3 % of setting value or $0.02 I_{pset}$
up to 50th harmonic, $f_{test} = 60 \text{ Hz}$: 4 % of setting value or $0.02 I_{pset}$

Test results/Remarks: up to 30th harmonic: 1 % of setting value or $0.005 I_{pset}$
up to 50th harmonic, $f_{test} = 50 \text{ Hz}$: 3 % of setting value or $0.02 I_{pset}$
up to 50th harmonic, $f_{test} = 60 \text{ Hz}$: 4 % of setting value or $0.02 I_{pset}$

Method of measurement = RMS value of phases,
with filter for the compensation of the amplitude attenuation due to the anti-aliasing:

Permissive tolerance/Limiting values: up to 30th harmonic: 1 % of setting value or $0.005 I_{pset}$
up to 50th harmonic, $f_{test} = 50 \text{ Hz}$: 2 % of setting value or $0.02 I_{pset}$
up to 50th harmonic, $f_{test} = 60 \text{ Hz}$: 3 % of setting value or $0.02 I_{pset}$

Test results/Remarks: up to 30th harmonic: 1 % of setting value or $0.005 I_{pset}$
up to 50th harmonic, $f_{test} = 50 \text{ Hz}$: 2 % of setting value or $0.02 I_{pset}$
up to 50th harmonic, $f_{test} = 60 \text{ Hz}$: 3 % of setting value or $0.02 I_{pset}$

Method of measurement = RMS value of phases,
with filter for the gain of harmonics (including compensation of the amplitude attenuation)¹

Permissive tolerance/Limiting values: up to 30th harmonic: 1.5 % of setting value or $0.01 I_{pset}$
up to 50th harmonic, $f_{test} = 50 \text{ Hz}$: 3 % of setting value or $0.02 I_{pset}$
up to 50th harmonic, $f_{test} = 60 \text{ Hz}$: 4 % of setting value or $0.02 I_{pset}$

Test results/Remarks: up to 30th harmonic: 1.5 % of setting value or $0.01 I_{pset}$
up to 50th harmonic, $f_{test} = 50 \text{ Hz}$: 3 % of setting value or $0.02 I_{pset}$
up to 50th harmonic, $f_{test} = 60 \text{ Hz}$: 4 % of setting value or $0.02 I_{pset}$

1.2.2.2 Dropout ratio

Test condition: see item 1.2.2.1

¹ In case that the filter response exactly matches the user defined gain factor
² In case that the user-defined gain factor is set below 3. The tolerance is amplified if the gain factor is larger
³ In case that the user-defined gain factor is set below 7. The tolerance is amplified if the gain factor is larger

Summary

Test values: $0.00 \leq r \leq 0.66$

Permissive tolerance/Limiting values: 1 % of dropout value

Test results/Remarks: 1 % of dropout value

1.2.2.3 Pickup times

Test condition: see item 1.2.2.1

Test values: 1.2³ threshold

Permissive tolerance/Limiting values: 1 approx.
25 ms + OOT at 50 Hz
22 ms + OOT at 60 Hz

Test results/Remarks: 1 approx.
25 ms + OOT at 50 Hz
22 ms + OOT at 60 Hz

1.2.2.4 Dropout times

Test condition: see item 1.2.2.1

Permissive tolerance/Limiting values: 1 approx.
20 ms + OOT

Test results/Remarks: 1 approx.
20 ms + OOT

1.2.2.5 Time delay

Test condition: see item 1.2.2.1
1.2³ threshold

Test values: $0.00 \leq T \leq 60.00 \text{ s}$

Permissive tolerance/Limiting values: 1 % of setting value or 30 ms

Test results/Remarks: 1 % of setting value or 30 ms

1.2.3 Overcurrent Protection, phases with inverse time overcurrent stage (inverse time)

1.2.3.1 Pickup values

Test condition: $0.030 I_{pmax}$ (threshold value) - $35.000 I_{pset}$
 $f_{test} = 50 \text{ Hz}, 60 \text{ Hz}$

Method of measurement = fundamental components of phases:

Permissive tolerance/Limiting values: 1 % of setting value or $0.005 I_{pset}$

Test results/Remarks: 1 % of setting value or $0.005 I_{pset}$

Method of measurement = RMS value of phases, no filter applied:

Permissive tolerance/Limiting values: up to 30th harmonic: 1 % of setting value or $0.005 I_{pset}$
up to 50th harmonic, $f_{test} = 50 \text{ Hz}$: 3 % of setting value or $0.02 I_{pset}$
up to 50th harmonic, $f_{test} = 60 \text{ Hz}$: 4 % of setting value or $0.02 I_{pset}$

Summary

Test results/Remarks: up to 30th harmonic: 1 % of setting value or $0.005 I_{pset}$
up to 50th harmonic, $f_{test} = 50 \text{ Hz}$: 2 % of setting value or $0.02 I_{pset}$
up to 50th harmonic, $f_{test} = 60 \text{ Hz}$: 3 % of setting value or $0.02 I_{pset}$

Method of measurement = RMS value of phases,
with filter for the compensation of the amplitude attenuation due to the anti-aliasing:

Permissive tolerance/Limiting values: up to 30th harmonic: 1 % of setting value or $0.005 I_{pset}$
up to 50th harmonic, $f_{test} = 50 \text{ Hz}$: 2 % of setting value or $0.02 I_{pset}$
up to 50th harmonic, $f_{test} = 60 \text{ Hz}$: 3 % of setting value or $0.02 I_{pset}$

Test results/Remarks: up to 30th harmonic: 1 % of setting value or $0.005 I_{pset}$
up to 50th harmonic, $f_{test} = 50 \text{ Hz}$: 2 % of setting value or $0.02 I_{pset}$
up to 50th harmonic, $f_{test} = 60 \text{ Hz}$: 3 % of setting value or $0.02 I_{pset}$

Method of measurement = RMS value of phases,
with filter for the gain of harmonics (including compensation of the amplitude attenuation)¹

Permissive tolerance/Limiting values: up to 30th harmonic: 1.5 % of setting value or $0.01 I_{pset}$
up to 50th harmonic, $f_{test} = 50 \text{ Hz}$: 3 % of setting value or $0.02 I_{pset}$
up to 50th harmonic, $f_{test} = 60 \text{ Hz}$: 4 % of setting value or $0.02 I_{pset}$

Test results/Remarks: up to 30th harmonic: 1.5 % of setting value or $0.01 I_{pset}$
up to 50th harmonic, $f_{test} = 50 \text{ Hz}$: 3 % of setting value or $0.02 I_{pset}$
up to 50th harmonic, $f_{test} = 60 \text{ Hz}$: 4 % of setting value or $0.02 I_{pset}$

1.2.3.2 Dropout ratio

Test condition: see item 1.2.3.1

Instantaneous:

Test values: $1.05 \cdot$ threshold value
 $0.85 \cdot$ pickup value

Drop emulation

Test values: $0.90 \cdot$ threshold value

Permissive tolerance/Limiting values: 1 % of dropout value

Test results/Remarks: 1 % of dropout value

1.2.3.3 Pickup times

Test condition: see item 1.2.3.1
1.2³ threshold

Permissive tolerance/Limiting values: 1 approx.
25 ms + OOT at 50 Hz
22 ms + OOT at 60 Hz

¹ In case that the filter response exactly matches the user defined gain factor
² In case that the user-defined gain factor is set below 3. The tolerance is amplified if the gain factor is larger
³ In case that the user-defined gain factor is set below 7. The tolerance is amplified if the gain factor is larger

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Summary

Test results/Remarks: 1 approx.
25 ms + OOT at 50 Hz
22 ms + OOT at 60 Hz

1.2.3.4 Dropout times

Test condition: see item 1.2.3.1

Permissive tolerance/Limiting values: 1 approx.
20 ms + OOT

Test results/Remarks: 1 approx.
20 ms + OOT

1.2.3.5 Tripping time characteristics

Test condition: see item 1.2.3.1
1.2³ threshold

Test values: Time del: $0.05 \leq T \leq 16.00$

Permissive tolerance/Limiting values: 5 % of the reference (calculated) value + 2 % of current tolerance or 30 ms

1.2.3.5.1 IEC normal Inverse (type A)

Test results/Remarks: 5 % of the reference (calculated) value + 2 % of current tolerance or 30 ms

1.2.3.5.2 IEC very Inverse (type B)

Test results/Remarks: 5 % of the reference (calculated) value + 2 % of current tolerance or 30 ms

1.2.3.5.3 IEC extremely Inverse (type C)

Test results/Remarks: 5 % of the reference (calculated) value + 2 % of current tolerance or 30 ms

1.2.3.5.4 IEC long-time Inverse (type B)

Test results/Remarks: 5 % of the reference (calculated) value + 2 % of current tolerance or 30 ms

1.2.3.5.5 ANSI long-time Inverse

Test results/Remarks: 5 % of the reference (calculated) value + 2 % of current tolerance or 30 ms

1.2.3.5.6 ANSI short-time Inverse

Test results/Remarks: 5 % of the reference (calculated) value + 2 % of current tolerance or 30 ms

1.2.3.5.7 ANSI extremely Inverse

Test results/Remarks: 5 % of the reference (calculated) value + 2 % of current tolerance or 30 ms

1.2.3.5.8 ANSI very Inverse

Test results/Remarks: 5 % of the reference (calculated) value + 2 % of current tolerance or 30 ms

1.2.3.5.9 ANSI normal Inverse

Test results/Remarks: 5 % of the reference (calculated) value + 2 % of current tolerance or 30 ms

1.2.3.5.10 ANSI moderately Inverse

Test results/Remarks: 5 % of the reference (calculated) value + 2 % of current tolerance or 30 ms

1.2.3.5.11 ANSI definite Inverse

Test results/Remarks: 5 % of the reference (calculated) value + 2 % of current tolerance or 30 ms

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Summary

1.2.3.6	Dropout characteristics	
Test condition:	see item 1.2.3.1 Disk emulation: 0.8*threshold	
Test values:	Time del: 0.05 - T : 15.00	
Permissive tolerance/limiting values:	5 % of the reference (calculated) value + 2 % of current tolerance or 30 ms	
1.2.3.6.1	IEC normal inverse (type A)	5 % of the reference (calculated) value + 2 % of current tolerance or 30 ms
Test results/Remarks:		
1.2.3.6.2	IEC very inverse (type B)	5 % of the reference (calculated) value + 2 % of current tolerance or 30 ms
Test results/Remarks:		
1.2.3.6.3	IEC extremely inverse (type C)	5 % of the reference (calculated) value + 2 % of current tolerance or 30 ms
Test results/Remarks:		
1.2.3.6.4	IEC long-time inverse (type D)	5 % of the reference (calculated) value + 2 % of current tolerance or 30 ms
Test results/Remarks:		
1.2.3.6.5	ANSI long-time Inverse	5 % of the reference (calculated) value + 2 % of current tolerance or 30 ms
Test results/Remarks:		
1.2.3.6.6	ANSI short-time Inverse	5 % of the reference (calculated) value + 2 % of current tolerance or 30 ms
Test results/Remarks:		
1.2.3.6.7	ANSI extremely Inverse	5 % of the reference (calculated) value + 2 % of current tolerance or 30 ms
Test results/Remarks:		
1.2.3.6.8	ANSI very Inverse	5 % of the reference (calculated) value + 2 % of current tolerance or 30 ms
Test results/Remarks:		
1.2.3.6.9	ANSI normal Inverse	5 % of the reference (calculated) value + 2 % of current tolerance or 30 ms
Test results/Remarks:		
1.2.3.6.10	ANSI moderately Inverse	5 % of the reference (calculated) value + 2 % of current tolerance or 30 ms
Test results/Remarks:		
1.2.3.6.11	ANSI definite Inverse	5 % of the reference (calculated) value + 2 % of current tolerance or 30 ms
Test results/Remarks:		
1.2.4	Overcurrent Protection, phases with user-defined characteristic ¹	
1.2.4.1	Pickup	
Test condition:	0.030 I _{pick} : threshold value ; 35.000 I _{pick} f _{pick} = 60 Hz, 60 Hz	
Method of measurement = fundamental components of phases:		
Permissive tolerance/limiting values:	1 % of setting value or 0.005 I _{pick}	
Test results/Remarks:	1 % of setting value or 0.005 I _{pick}	

¹ Not available for Busbar Protection

Summary

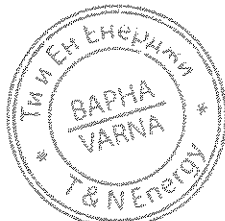
Method of measurement = RMS value of phases, no filter applied.

Permissive tolerance/limiting values:	up to 30th harmonic: 1 % of setting value or 0.005 I _{pick} up to 60th harmonic, f _{pick} = 60 Hz: 3 % of setting value or 0.02 I _{pick} up to 50th harmonic, f _{pick} = 60 Hz: 4 % of setting value or 0.02 I _{pick}
Test results/Remarks:	up to 30th harmonic: 1 % of setting value or 0.005 I _{pick} up to 60th harmonic, f _{pick} = 60 Hz: 3 % of setting value or 0.02 I _{pick} up to 50th harmonic, f _{pick} = 60 Hz: 4 % of setting value or 0.02 I _{pick}
Method of measurement = RMS value of phases,	
with filter for the compensation of the amplitude attenuation due to the anti-aliasing:	
Permissive tolerance/limiting values:	up to 30th harmonic: 1 % of setting value or 0.005 I _{pick} up to 50th harmonic, f _{pick} = 60 Hz: 2 % of setting value or 0.02 I _{pick} up to 60th harmonic, f _{pick} = 60 Hz: 3 % of setting value or 0.02 I _{pick}
Test results/Remarks:	up to 30th harmonic: 1 % of setting value or 0.005 I _{pick} up to 60th harmonic, f _{pick} = 60 Hz: 2 % of setting value or 0.02 I _{pick} up to 50th harmonic, f _{pick} = 60 Hz: 3 % of setting value or 0.02 I _{pick}
Method of measurement = RMS value of phases,	
with filter for the gain of harmonics (including compensation of the amplitude attenuation) ²	
Permissive tolerance/limiting values:	up to 30th harmonic: 1.5 % of setting value or 0.01 I _{pick} up to 50th harmonic, f _{pick} = 60 Hz: 3 % of setting value or 0.02 I _{pick} up to 60th harmonic, f _{pick} = 60 Hz: 4 % of setting value or 0.02 I _{pick}
Test results/Remarks:	up to 30th harmonic: 1.5 % of setting value or 0.01 I _{pick} up to 50th harmonic, f _{pick} = 60 Hz: 3 % of setting value or 0.02 I _{pick} up to 60th harmonic, f _{pick} = 60 Hz: 4 % of setting value or 0.02 I _{pick}
1.2.4.2	Dropout ratio
Test condition:	see item 1.2.4.1
Instantaneous:	
Test values:	1.05 * threshold value 0.95 * pickup value
Disk emulation:	
Test values:	0.90 * threshold value
Permissive tolerance/limiting values:	1 % of dropout value
Test results/Remarks:	1 % of dropout value
1.2.4.3	Pickup times
Test condition:	see item 1.2.4.1 1.2*threshold

¹ In case that the filter response exactly matches the user defined gain factor
² In case that the user-defined gain factor is set below 3. The tolerance is amplified if the gain factor is larger
³ In case that the user-defined gain factor is set below 7. The tolerance is amplified if the gain factor is larger

Summary

Permissive tolerance/limiting values:	1 approx. 25 ms + OOT at 60 Hz 22 ms + OOT at 60 Hz
Test results/Remarks:	1 approx. 25 ms + OOT at 60 Hz 25 ms + OOT at 60 Hz
1.2.4.4	Dropout times
Test condition:	see item 1.2.4.1
Permissive tolerance/limiting values:	1 approx. 25 ms + OOT
Test results/Remarks:	1 approx. 25 ms + OOT
1.2.4.5	Tripping time characteristics
Test condition:	see item 1.2.4.1 1.2*threshold
Test values:	Time del: 0.05 - T : 15.00
Permissive tolerance/limiting values:	5 % of the reference (calculated) value + 2 % of current tolerance or 30 ms
Test results/Remarks:	5 % of the reference (calculated) value + 2 % of current tolerance or 30 ms
1.2.4.6	Dropout characteristics
Test condition:	see item 1.2.4.1 Disk emulation: 0.8*threshold
Test values:	Time del: 0.05 - T : 15.00
Permissive tolerance/limiting values:	5 % of the reference (calculated) value + 2 % of current tolerance or 30 ms
Test results/Remarks:	5 % of the reference (calculated) value + 2 % of current tolerance or 30 ms



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Summary

1.3	50N/51N Overcurrent Protection, Ground
1.3.1	Specifications
	- VDE 435 - IECEN 60255-1, item 7, Annex A, B - IECEN 60255-151
1.3.2	Overcurrent Protection, ground with definite time overcurrent stages (definite time)
1.3.2.1	Pickup values
Test condition:	0.010 I _{pick} : threshold value ; 35.000 I _{pick} for protection CT 0.001 A : threshold value ; 1.600 A for instrument CT (Current range: 1.6A) 0.002 A : threshold value ; 2.000 A for instrument CT (Current range: 6A) f _{pick} = 60 Hz, 60 Hz
Method of measurement = fundamental components of phases and 2IG:	
Permissive tolerance/limiting values:	For protection CT: 1 % of setting value or 0.005 I _{pick} For instrument CT: 1 % of setting value or 0.0005 I _{pick}
Test results/Remarks:	For protection CT: 1 % of setting value or 0.005 I _{pick} For instrument CT: 1 % of setting value or 0.0005 I _{pick}
Method of measurement = RMS value of phases and 2IG:	
Permissive tolerance/limiting values:	For protection CT: up to 30th harmonic: 1 % of setting value or 0.005 I _{pick} up to 50th harmonic, f _{pick} = 60 Hz: 3 % of setting value or 0.02 I _{pick} up to 60th harmonic, f _{pick} = 60 Hz: 4 % of setting value or 0.02 I _{pick} For instrument CT: up to 30th harmonic: 1 % of setting value or 0.0005 I _{pick} up to 50th harmonic, f _{pick} = 60 Hz: 3 % of setting value or 0.001 I _{pick} up to 60th harmonic, f _{pick} = 60 Hz: 4 % of setting value or 0.001 I _{pick}
Test results/Remarks:	For protection CT: up to 30th harmonic: 1 % of setting value or 0.005 I _{pick} up to 50th harmonic, f _{pick} = 60 Hz: 3 % of setting value or 0.02 I _{pick} up to 60th harmonic, f _{pick} = 60 Hz: 4 % of setting value or 0.02 I _{pick} For instrument CT: up to 30th harmonic: 1 % of setting value or 0.0005 I _{pick} up to 50th harmonic, f _{pick} = 60 Hz: 3 % of setting value or 0.001 I _{pick} up to 60th harmonic, f _{pick} = 60 Hz: 4 % of setting value or 0.001 I _{pick}
1.3.2.2	Dropout ratio
Test condition:	see item 1.3.2.1
Test values:	For protection CT: 65 % of threshold value or 0.016 I _{pick} or 60 % of threshold value (for secondary current threshold > 0.030 I _{pick}) For instrument CT: 65 % of threshold value or 0.0005 I _{pick} or 50 % of threshold value (for secondary current threshold > 0.001 I _{pick})
Permissive tolerance/limiting values:	For protection CT: 1 % of setting value or 0.005 I _{pick} For instrument CT: 1 % of setting value or 0.0005 I _{pick}
Test results/Remarks:	For protection CT: 1 % of setting value or 0.005 I _{pick} For instrument CT: 1 % of setting value or 0.0005 I _{pick}
1.3.2.3	Pickup times
Test condition:	see item 1.3.2.1
Test values:	1.2*threshold

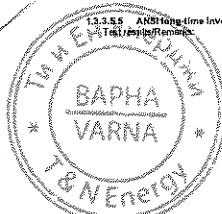
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Summary

Permissive tolerance/Limiting values:	1 approx. 25 ms + OOT at 50 Hz 22 ms + OOT at 60 Hz
Test results/Remarks:	1 approx. 25 ms + OOT at 50 Hz 22 ms + OOT at 60 Hz
1.3.2.4 Dropout times	
Test condition:	see item 1.3.2.1
Permissive tolerance/Limiting values:	1 approx. 20 ms + OOT
Test results/Remarks:	1 approx. 20 ms + OOT
1.3.2.5 Time delay	
Test condition:	see item 1.3.2.1 1.2*threshold
Test values:	0.00 s ... T ... 10.00 s
Permissive tolerance/Limiting values:	1 % of setting value or 30 ms
Test results/Remarks:	1 % of setting value or 30 ms
1.3.3 Overcurrent Protection, ground with inverse time overcurrent stage (inverse time)	
1.3.3.1 Pickup values	
Test condition:	0.010 I _{rated} - threshold value > 35.000 I _{rated} for protection CT 0.001 A - threshold value - 1.600 A for instrument CT (Current range: 1.6A) 0.002 A - threshold value - 8.000 A for instrument CT (Current range: 8A) I _{rated} = 50 Hz, 60 Hz
Method of measurement = fundamental components of phases and 3rd:	
Permissive tolerance/Limiting values:	For protection CT: 1 % of setting value or 0.005 I _{rated} For instrument CT: 1 % of setting value or 0.0005 I _{rated}
Test results/Remarks:	For protection CT: 1 % of setting value or 0.005 I _{rated} For instrument CT: 1 % of setting value or 0.0005 I _{rated}
Method of measurement = RMS value of phases and 3rd:	
Permissive tolerance/Limiting values:	For protection CT: up to 30th harmonics: 1 % of setting value or 0.005 I _{rated} up to 50th harmonic, I _{rated} = 50 Hz: 3 % of setting value or 0.02 I _{rated} up to 50th harmonic, I _{rated} = 60 Hz: 4 % of setting value or 0.02 I _{rated} For instrument CT: up to 30th harmonics: 1 % of setting value or 0.0005 I _{rated} up to 50th harmonic, I _{rated} = 50 Hz: 3 % of setting value or 0.001 I _{rated} up to 50th harmonic, I _{rated} = 60 Hz: 4 % of setting value or 0.001 I _{rated}
Test results/Remarks:	For protection CT: up to 30th harmonics: 1 % of setting value or 0.005 I _{rated} up to 50th harmonic, I _{rated} = 50 Hz: 3 % of setting value or 0.02 I _{rated} up to 50th harmonic, I _{rated} = 60 Hz: 4 % of setting value or 0.02 I _{rated} For instrument CT: up to 30th harmonics: 1 % of setting value or 0.0005 I _{rated} up to 50th harmonic, I _{rated} = 50 Hz: 3 % of setting value or 0.001 I _{rated} up to 50th harmonic, I _{rated} = 60 Hz: 4 % of setting value or 0.001 I _{rated}
1.3.3.2 Dropout ratio	
Test condition:	see item 1.3.3.1
Instantaneous:	

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Test values:	For protection CT: 95 % of pickup value or 0.015 I _{rated} or 50% of pickup value (for secondary current threshold - 0.030 I _{rated}) For instrument CT: 85 % of pickup value or 0.0005 I _{rated} or 50% of pickup value (for secondary current threshold - 0.001 I _{rated})
Disk emulation	
Test values:	00% of pickup value
Permissive tolerance/Limiting values:	For protection CT: 1 % of setting value or 0.005 I _{rated} For instrument CT: 1 % of setting value or 0.0005 I _{rated}
Test results/Remarks:	For protection CT: 1 % of setting value or 0.005 I _{rated} For instrument CT: 1 % of setting value or 0.0005 I _{rated}
1.3.3.3 Pickup times	
Test condition:	see item 1.3.3.1 1.2*threshold
Permissive tolerance/Limiting values:	1 approx. 25 ms + OOT at 50 Hz 22 ms + OOT at 60 Hz
Test results/Remarks:	1 approx. 25 ms + OOT at 50 Hz 22 ms + OOT at 60 Hz
1.3.3.4 Dropout times	
Test condition:	see item 1.3.3.1
Permissive tolerance/Limiting values:	1 approx. 20 ms + OOT
Test results/Remarks:	1 approx. 20 ms + OOT
1.3.3.5 Tripping time characteristics	
Test condition:	see item 1.3.3.1 1.2*threshold
Test values:	Time dial: 0.05 ... T ... 15.00
Permissive tolerance/Limiting values:	5 % of the reference (calculated) value + 2 % of current tolerance or 30 ms
1.3.3.5.1 IEC normal inverse (type A)	
Test results/Remarks:	5 % of the reference (calculated) value + 2 % of current tolerance or 30 ms
1.3.3.5.2 IEC very inverse (type B)	
Test results/Remarks:	5 % of the reference (calculated) value + 2 % of current tolerance or 30 ms
1.3.3.5.3 IEC extremely inverse (type C)	
Test results/Remarks:	6 % of the reference (calculated) value + 2 % of current tolerance or 30 ms
1.3.3.5.4 IEC long-time inverse (type B)	
Test results/Remarks:	5 % of the reference (calculated) value + 2 % of current tolerance or 30 ms
1.3.3.5.5 ANSI long-time inverse (type B)	
Test results/Remarks:	6 % of the reference (calculated) value + 2 % of current tolerance or 30 ms

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1.3.3.5.6 ANSI short-time Inverse	
Test results/Remarks:	5 % of the reference (calculated) value + 2 % of current tolerance or 30 ms
1.3.3.5.7 ANSI extremely inverse	
Test results/Remarks:	5 % of the reference (calculated) value + 2 % of current tolerance or 30 ms
1.3.3.5.8 ANSI very inverse	
Test results/Remarks:	5 % of the reference (calculated) value + 2 % of current tolerance or 30 ms
1.3.3.5.9 ANSI normal Inverse	
Test results/Remarks:	6 % of the reference (calculated) value + 2 % of current tolerance or 30 ms
1.3.3.5.10 ANSI moderately inverse	
Test results/Remarks:	5 % of the reference (calculated) value + 2 % of current tolerance or 30 ms
1.3.3.5.11 ANSI definite inverse	
Test results/Remarks:	5 % of the reference (calculated) value + 2 % of current tolerance or 30 ms
1.3.3.6 Dropout characteristics	
Test condition:	see item 1.3.3.1 Disk emulation: 0.8*threshold
Test values:	Time dial: 0.05 ... T ... 15.00
Permissive tolerance/Limiting values:	5 % of the reference (calculated) value + 2 % of current tolerance or 30 ms
1.3.3.6.1 IEC normal Inverse (type A)	
Test results/Remarks:	5 % of the reference (calculated) value + 2 % of current tolerance or 30 ms
1.3.3.6.2 IEC very inverse (type B)	
Test results/Remarks:	5 % of the reference (calculated) value + 2 % of current tolerance or 30 ms
1.3.3.6.3 IEC extremely inverse (type C)	
Test results/Remarks:	5 % of the reference (calculated) value + 2 % of current tolerance or 30 ms
1.3.3.6.4 IEC long-time inverse (type B)	
Test results/Remarks:	5 % of the reference (calculated) value + 2 % of current tolerance or 30 ms
1.3.3.6.5 ANSI long-time inverse	
Test results/Remarks:	5 % of the reference (calculated) value + 2 % of current tolerance or 30 ms
1.3.3.6.6 ANSI short-time inverse	
Test results/Remarks:	5 % of the reference (calculated) value + 2 % of current tolerance or 30 ms
1.3.3.6.7 ANSI extremely inverse	
Test results/Remarks:	5 % of the reference (calculated) value + 2 % of current tolerance or 30 ms
1.3.3.6.8 ANSI very inverse	
Test results/Remarks:	5 % of the reference (calculated) value + 2 % of current tolerance or 30 ms
1.3.3.6.9 ANSI normal Inverse	
Test results/Remarks:	5 % of the reference (calculated) value + 2 % of current tolerance or 30 ms
1.3.3.6.10 ANSI moderately inverse	
Test results/Remarks:	6 % of the reference (calculated) value + 2 % of current tolerance or 30 ms

Summary

1.3.3.6.11 ANSI definite inverse	
Test results/Remarks:	5 % of the reference (calculated) value + 2 % of current tolerance or 30 ms
1.3.4 Overcurrent Protection, ground with user-defined characteristic ¹	
1.3.4.1 Pickup	
Test condition:	0.010 I _{rated} - threshold value - 35.000 I _{rated} for protection CT 0.001 A - threshold value - 1.600 A for instrument CT (Current range: 1.6A) 0.002 A - threshold value - 8.000 A for instrument CT (Current range: 8A) I _{rated} = 50 Hz, 60 Hz
Method of measurement = fundamental components of phases and 3rd:	
Permissive tolerance/Limiting values:	For protection CT: 1 % of setting value or 0.005 I _{rated} For instrument CT: 1 % of setting value or 0.0005 I _{rated}
Test results/Remarks:	For protection CT: 1 % of setting value or 0.005 I _{rated} For instrument CT: 1 % of setting value or 0.0005 I _{rated}
Method of measurement = RMS value of phases and 3rd:	
Permissive tolerance/Limiting values:	For protection CT: up to 30th harmonics: 1 % of setting value or 0.005 I _{rated} up to 50th harmonic, I _{rated} = 50 Hz: 3 % of setting value or 0.02 I _{rated} up to 50th harmonic, I _{rated} = 60 Hz: 4 % of setting value or 0.02 I _{rated} For instrument CT: up to 30th harmonics: 1 % of setting value or 0.0005 I _{rated} up to 50th harmonic, I _{rated} = 50 Hz: 3 % of setting value or 0.001 I _{rated} up to 50th harmonic, I _{rated} = 60 Hz: 4 % of setting value or 0.001 I _{rated}
Test results/Remarks:	For protection CT: up to 30th harmonics: 1 % of setting value or 0.005 I _{rated} up to 50th harmonic, I _{rated} = 50 Hz: 3 % of setting value or 0.02 I _{rated} up to 50th harmonic, I _{rated} = 60 Hz: 4 % of setting value or 0.02 I _{rated} For instrument CT: up to 30th harmonics: 1 % of setting value or 0.0005 I _{rated} up to 50th harmonic, I _{rated} = 50 Hz: 3 % of setting value or 0.001 I _{rated} up to 50th harmonic, I _{rated} = 60 Hz: 4 % of setting value or 0.001 I _{rated}
1.3.4.2 Dropout ratio	
Test condition:	see item 1.3.4.1
Instantaneous:	
Test values:	For protection CT: 95 % of pickup value or 0.015 I _{rated} or 50% of pickup value (for secondary current threshold - 0.030 I _{rated}) For instrument CT: 85 % of pickup value or 0.0005 I _{rated} or 50% of pickup value (for secondary current threshold - 0.001 I _{rated})
Disk emulation	
Test values:	00% of pickup value
Permissive tolerance/Limiting values:	For protection CT: 1 % of setting value or 0.005 I _{rated} For instrument CT: 1 % of setting value or 0.0005 I _{rated}
Test results/Remarks:	For protection CT: 1 % of setting value or 0.005 I _{rated} For instrument CT: 1 % of setting value or 0.0005 I _{rated}

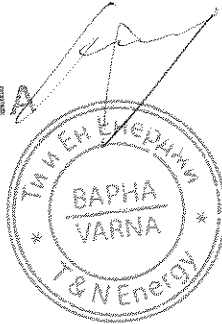
¹ Not available for Busbar Protection

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Summary

1.3.4.3 Pickup times	
Test condition:	see item 1.3.4.1 1.2" threshold
Permissible tolerance/limiting values:	1 approx. 35 ms + OOT at 50 Hz 22 ms + OOT at 60 Hz
Test results/Remarks:	1 approx. 25 ms + OOT at 50 Hz 25 ms + OOT at 60 Hz
1.3.4.4 Dropout times	
Test condition:	see item 1.3.4.1
Permissible tolerance/limiting values:	1 approx. 25 ms + OOT
Test results/Remarks:	1 approx. 25 ms + OOT
1.3.4.5 Tripping time characterization	
Test condition:	see item 1.3.4.1 1.2" threshold
Test values:	Time dial: 0.05 ; T ₁ : 15.00
Permissible tolerance/limiting values:	5 % of the reference (calculated) value + 2 % of current tolerance or 30 ms
Test results/Remarks:	5 % of the reference (calculated) value + 2 % of current tolerance or 30 ms
1.3.4.6 Dropout characteristics	
Test condition:	see item 1.3.4.1 Disk emulation: 0.8" threshold
Test values:	Time dial: 0.05 ; T ₁ : 15.00
Permissible tolerance/limiting values:	5 % of the reference (calculated) value + 2 % of current tolerance or 30 ms
Test results/Remarks:	5 % of the reference (calculated) value + 2 % of current tolerance or 30 ms

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Test results/Remarks:	In the range I _{pick} ± 10 % 0.5 % of setting value or 0.05 V
1.4.2.4 Pickup time	
Test condition:	see item 1.4.2.1
Test values:	1.2" threshold
Permissible tolerance/limiting values:	1 approx. 25 ms + OOT at 50 Hz 22 ms + OOT at 60 Hz
Test results/Remarks:	1 approx. 25 ms + OOT at 50 Hz 22 ms + OOT at 60 Hz
1.4.2.5 Dropout times	
Test condition:	see item 1.4.2.1
Permissible tolerance/limiting values:	1 approx. 20 ms + OOT
Test results/Remarks:	1 approx. 20 ms + OOT
1.4.2.6 Tripping time characteristics	
Test condition:	see item 1.4.2.1 1.2" threshold
Test values:	Time dial: 0.05 ; T ₁ : 15.00
Permissible tolerance/limiting values:	5 % of setting value or + 2 % of current tolerance or 30 ms
1.4.2.6.1 IEC normal Inverse (type A)	Test results/Remarks: 5 % of setting value or + 2 % of current tolerance or 30 ms
1.4.2.6.2 IEC very Inverse (type B)	Test results/Remarks: 5 % of setting value or + 2 % of current tolerance or 30 ms
1.4.2.6.3 IEC extremely Inverse (type C)	Test results/Remarks: 5 % of setting value or + 2 % of current tolerance or 30 ms
1.4.2.6.4 IEC long-time Inverse (type B)	Test results/Remarks: 5 % of setting value or + 2 % of current tolerance or 30 ms
1.4.2.6.5 ANSI long-time Inverse	Test results/Remarks: 5 % of setting value or + 2 % of current tolerance or 30 ms
1.4.2.6.6 ANSI short-time Inverse	Test results/Remarks: 5 % of setting value or + 2 % of current tolerance or 30 ms
1.4.2.6.7 ANSI extremely Inverse	Test results/Remarks: 5 % of setting value or + 2 % of current tolerance or 30 ms

Summary

1.4 51V Voltage-dependent Overcurrent-Protection	
1.4.1 Specifications	
	- VDE 0435 - IEC/EN 60255-1, Item 7, Annex A, B - IEC/EN 60255-127
1.4.2 Voltage-released stage	
1.4.2.1 Pickup values I _p	
Test condition:	0.050 I _{pick} > threshold value > 35.000 I _{pick}
Test values:	I _{pick} = 50 Hz, 60 Hz 0.050 I _{pick} - threshold value : 18.000 I _{pick}
<u>Method of measurement = fundamental components of phasor</u>	
Permissible tolerance/limiting values:	1 % of setting value or 0.005 I _{pick}
Test results/Remarks:	1 % of setting value or 0.005 I _{pick}
<u>Method of measurement = RMS value of phasor</u>	
Permissible tolerance/limiting values:	up to 30th harmonic: 1 % of setting value or 0.005 I _{pick} up to 50th harmonic, f _{max} = 60 Hz: 5 % of setting value or 0.02 I _{pick} up to 60th harmonic, f _{max} = 60 Hz: 4 % of setting value or 0.02 I _{pick}
Test results/Remarks:	up to 30 th harmonic: 1 % of setting value or 0.005 I _{pick} up to 50th harmonic, f _{max} = 60 Hz: 5 % of setting value or 0.02 I _{pick} up to 60th harmonic, f _{max} = 60 Hz: 4 % of setting value or 0.02 I _{pick}
1.4.2.2 Dropout ratio	
Test condition:	see item 1.4.2.1
Insataneous:	
Test values:	1.05 * threshold value 0.85 * pickup value
Disk emulation	
Test values:	0.90 * threshold value
Permissible tolerance/limiting values:	1 % of dropout value
Test results/Remarks:	1 % of dropout value
1.4.2.3 Pickup values V _{ph-ph}	
Test condition:	0.300 V _{ph} > threshold value > 175.000V
Test values:	0.300 V _{ph} - threshold value : 175.000V
Permissible tolerance/limiting values:	In the range I _{pick} ± 10 % 0.5 % of setting value or 0.05 V

Summary

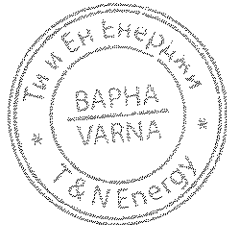
1.4.2.6.8 ANSI very Inverse	Test results/Remarks: 5 % of setting value or + 2 % of current tolerance or 30 ms
1.4.2.6.9 ANSI normal Inverse	Test results/Remarks: 5 % of setting value or + 2 % of current tolerance or 30 ms
1.4.2.6.10 ANSI moderately Inverse	Test results/Remarks: 5 % of setting value or + 2 % of current tolerance or 30 ms
1.4.2.6.11 ANSI definite Inverse	Test results/Remarks: 5 % of setting value or + 2 % of current tolerance or 30 ms
1.4.2.7 Dropout characteristics	
Test condition:	see item 1.4.2.1
Disk emulation:	0.8" threshold
Test values:	Time dial: 0.05 ; T ₁ : 15.00
Permissible tolerance/limiting values:	5 % of setting value or + 2 % of current tolerance or 30 ms
1.4.2.7.1 IEC normal Inverse (type A)	Test results/Remarks: 5 % of setting value or + 2 % of current tolerance or 30 ms
1.4.2.7.2 IEC very Inverse (type B)	Test results/Remarks: 5 % of setting value or + 2 % of current tolerance or 30 ms
1.4.2.7.3 IEC extremely Inverse (type C)	Test results/Remarks: 5 % of setting value or + 2 % of current tolerance or 30 ms
1.4.2.7.4 IEC long-time Inverse (type B)	Test results/Remarks: 5 % of setting value or + 2 % of current tolerance or 30 ms
1.4.2.7.5 ANSI long-time Inverse	Test results/Remarks: 5 % of setting value or + 2 % of current tolerance or 30 ms
1.4.2.7.6 ANSI short-time Inverse	Test results/Remarks: 5 % of setting value or + 2 % of current tolerance or 30 ms
1.4.2.7.7 ANSI extremely Inverse	Test results/Remarks: 5 % of setting value or + 2 % of current tolerance or 30 ms
1.4.2.7.8 ANSI very Inverse	Test results/Remarks: 5 % of setting value or + 2 % of current tolerance or 30 ms
1.4.2.7.9 ANSI normal Inverse	Test results/Remarks: 5 % of setting value or + 2 % of current tolerance or 30 ms
1.4.2.7.10 ANSI moderately Inverse	Test results/Remarks: 5 % of setting value or + 2 % of current tolerance or 30 ms
1.4.2.7.11 ANSI definite Inverse	Test results/Remarks: 5 % of setting value or + 2 % of current tolerance or 30 ms

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1.4.3	Voltage-dependent Stage	
1.4.3.1	Pickup values P	
Test condition:	0.030 I _{nom} ± threshold value ± 35.000 I _{nom}	
Test values:	f _{test} = 50 Hz, 60 Hz 0.030 I _{nom} ± threshold value ± 18.000 I _{nom}	
<u>Method of measurement = fundamental components of phases</u>		
Permissive tolerance/Limiting values:	1 % of setting value or 0.005 I _{nom}	
Test results/Remarks:	1 % of setting value or 0.005 I _{nom}	
<u>Method of measurement = RMS value of phases</u>		
Permissive tolerance/Limiting values:	up to 30th harmonic: 1 % of setting value or 0.005 I _{nom} up to 50th harmonic: f _{test} = 60 Hz: 3 % of setting value or 0.02 I _{nom} up to 50th harmonic: f _{test} = 60 Hz: 4 % of setting value or 0.02 I _{nom}	
Test results/Remarks:	up to 30 th harmonic: 1 % of setting value or 0.005 I _{nom} up to 50th harmonic: f _{test} = 60 Hz: 3 % of setting value or 0.02 I _{nom} up to 50th harmonic: f _{test} = 60 Hz: 4 % of setting value or 0.02 I _{nom}	
1.4.3.2	Dropout ratio	
Test condition:	see item 1.4.3.1	
Instantaneous:		
Test values:	1.05 * threshold value 0.99 * pickup value	
Disk emulation		
Test values:	0.90 * threshold value	
Permissive tolerance/Limiting values:	1 % of dropout value	
Test results/Remarks:	1% of dropout value	
1.4.3.3	Pickup time	
Test condition:	see item 1.4.3.1	
Test values:	1.2*threshold	
Permissive tolerance/Limiting values:	1 approx. 25 ms + OOT at 50 Hz 22 ms + OOT at 60 Hz	
Test results/Remarks:	1 approx. 25 ms + OOT at 60 Hz 22 ms + OOT at 60 Hz	
1.4.3.4	Dropout times	
Test condition:	see item 1.4.3.1	



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Permissive tolerance/Limiting values:	1 approx. 20 ms + OOT
Test results/Remarks:	1 approx. 20 ms + OOT
1.4.3.5	Tripping time characteristics
Test condition:	see item 1.4.3.1 1.2*threshold
Test values:	Time dial: 0.05 - T = 16.00
Permissive tolerance/Limiting values:	5 % of setting value or + 2 % of current tolerance or 30 ms
1.4.3.5.1	IEC normal Inverse (type A)
Test results/Remarks:	5 % of setting value or + 2 % of current tolerance or 30 ms
1.4.3.5.2	IEC very Inverse (type B)
Test results/Remarks:	5 % of setting value or + 2 % of current tolerance or 30 ms
1.4.3.5.3	IEC extremely Inverse (type C)
Test results/Remarks:	5 % of setting value or + 2 % of current tolerance or 30 ms
1.4.3.5.4	IEC long-time Inverse (type B)
Test results/Remarks:	5 % of setting value or + 2 % of current tolerance or 30 ms
1.4.3.5.5	ANSI long-time Inverse
Test results/Remarks:	6 % of setting value or + 2 % of current tolerance or 30 ms
1.4.3.5.6	ANSI short-time Inverse
Test results/Remarks:	5 % of setting value or + 2 % of current tolerance or 30 ms
1.4.3.5.7	ANSI extremely Inverse
Test results/Remarks:	5 % of setting value or + 2 % of current tolerance or 30 ms
1.4.3.5.8	ANSI very Inverse
Test results/Remarks:	5 % of setting value or + 2 % of current tolerance or 30 ms
1.4.3.5.9	ANSI normal Inverse
Test results/Remarks:	5 % of setting value or + 2 % of current tolerance or 30 ms
1.4.3.5.10	ANSI moderately Inverse
Test results/Remarks:	5 % of setting value or + 2 % of current tolerance or 30 ms
1.4.3.5.11	ANSI definite Inverse
Test results/Remarks:	5 % of setting value or + 2 % of current tolerance or 30 ms
1.4.3.8	Dropout characteristics
Test condition:	see item 1.4.3.1
Disk emulation:	0.8*threshold
Test values:	Time dial: 0.05 - T = 16.00

Summary

Permissive tolerance/Limiting values:	5 % of setting value or + 2 % of current tolerance or 30 ms
1.4.3.6.1	IEC normal Inverse (type A)
Test results/Remarks:	6 % of setting value or + 2 % of current tolerance or 30 ms
1.4.3.6.2	IEC very Inverse (type B)
Test results/Remarks:	6 % of setting value or + 2 % of current tolerance or 30 ms
1.4.3.6.3	IEC extremely Inverse (type C)
Test results/Remarks:	5 % of setting value or + 2 % of current tolerance or 30 ms
1.4.3.6.4	IEC long-time Inverse (type B)
Test results/Remarks:	5 % of setting value or + 2 % of current tolerance or 30 ms
1.4.3.6.5	ANSI long-time Inverse
Test results/Remarks:	5 % of setting value or + 2 % of current tolerance or 30 ms
1.4.3.6.6	ANSI short-time Inverse
Test results/Remarks:	5 % of setting value or + 2 % of current tolerance or 30 ms
1.4.3.6.7	ANSI extremely Inverse
Test results/Remarks:	6 % of setting value or + 2 % of current tolerance or 30 ms
1.4.3.6.8	ANSI very Inverse
Test results/Remarks:	5 % of setting value or + 2 % of current tolerance or 30 ms
1.4.3.6.9	ANSI normal Inverse
Test results/Remarks:	5 % of setting value or + 2 % of current tolerance or 30 ms
1.4.3.6.10	ANSI moderately Inverse
Test results/Remarks:	5 % of setting value or + 2 % of current tolerance or 30 ms
1.4.3.6.11	ANSI definite Inverse
Test results/Remarks:	5 % of setting value or + 2 % of current tolerance or 30 ms
1.4.4	Undervoltage seal-in stage
1.4.4.1	Pickup values P
Test condition:	0.030 I _{nom} ± threshold value ± 35.000 I _{nom}
Test values:	f _{test} = 50 Hz, 60 Hz 0.030 I _{nom} ± threshold value ± 35.000 I _{nom}
<u>Method of measurement = fundamental components of phases</u>	
Permissive tolerance/Limiting values:	1 % of setting value or 0.005 I _{nom}
Test results/Remarks:	1 % of setting value or 0.005 I _{nom}
<u>Method of measurement = RMS value of phases</u>	
Permissive tolerance/Limiting values:	up to 30th harmonic: 1 % of setting value or 0.005 I _{nom} up to 50th harmonic: f _{test} = 60 Hz: 3 % of setting value or 0.02 I _{nom} up to 50th harmonic: f _{test} = 60 Hz: 4 % of setting value or 0.02 I _{nom}

Summary

Test results/Remarks:	up to 30th harmonic: 1 % of setting value or 0.005 I _{nom} up to 50th harmonic: f _{test} = 60 Hz: 3 % of setting value or 0.02 I _{nom} up to 50th harmonic: f _{test} = 60 Hz: 4 % of setting value or 0.02 I _{nom}
1.4.4.2	Dropout ratio
Test condition:	see item 1.4.4.1
Test values:	0.90 ± r - 0.89
Permissive tolerance/Limiting values:	1 % of dropout value
Test results/Remarks:	1 % of dropout value
1.4.4.3	Pickup values V-seal-in
Test condition:	0.300 V ± threshold value ± 175.000V
Test values:	0.300 V ± threshold value ± 175.000V
Permissive tolerance/Limiting values:	In the range I _{test} ±10 % 0.5 % of setting value or 0.05 V
Test results/Remarks:	In the range I _{test} ±10 % 0.5 % of setting value or 0.05 V
1.4.4.4	Dropout ratio of V-seal-in
Test condition:	0.300 V ± threshold value ± 175.000V
Test values:	1.01 ± r - 1.20
Permissive tolerance/Limiting values:	1 % of dropout value
Test results/Remarks:	1 % of dropout value
1.4.4.5	Pickup times
Test condition:	see item 1.4.4.1
Test values:	1.2*threshold
Permissive tolerance/Limiting values:	1 approx. 30 ms + OOT at 50 Hz 25 ms + OOT at 60 Hz
Test results/Remarks:	1 approx. 30 ms + OOT at 50 Hz 25 ms + OOT at 60 Hz
1.4.4.8	Dropout times
Test condition:	see item 1.4.4.1
Permissive tolerance/Limiting values:	1 approx. 20 ms + OOT

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Summary

Test results/Remarks:	1 approx. 20 ms + OOT
1.4.4.7 Operate delays	
Test condition:	$I_{L\text{-}0}$ value
Test values:	0.00 s ; $T \leq 80.00$ s
Permissive tolerance/limiting values:	1 % of setting value or 10 ms
Test results/Remarks:	1 % of setting value or 10 ms
1.4.4.8 Duration of V-sag-in time	
Test condition:	$I_{L\text{-}0}$ value
Test values:	0.10 s ; $T \leq 80.00$ s
Permissive tolerance/limiting values:	1 % of setting value or 10 ms
Test results/Remarks:	1 % of setting value or 10 ms
1.4.5 Undervoltage Sag-In and voltage released stage	
1.4.5.1 Pickup values V1	
Test condition:	0.030 $I_{L\text{-}0}$; threshold value = 35.000 $I_{L\text{-}0}$
Test values:	$f_{\text{min}} = 50$ Hz, 60 Hz 0.030 $I_{L\text{-}0}$; threshold value = 35.000 $I_{L\text{-}0}$
Method of measurement = fundamental components of phasor	
Permissive tolerance/limiting values:	1 % of setting value or 0.005 $I_{L\text{-}0}$
Test results/Remarks:	1 % of setting value or 0.005 $I_{L\text{-}0}$
Method of measurement = RMS value of phasor	
Permissive tolerance/limiting values:	up to 30th harmonic: 1 % of setting value or 0.005 $I_{L\text{-}0}$ up to 50th harmonic, $f_{\text{min}} = 50$ Hz: 3 % of setting value or 0.02 $I_{L\text{-}0}$ up to 50th harmonic, $f_{\text{min}} = 60$ Hz: 4 % of setting value or 0.02 $I_{L\text{-}0}$
Test results/Remarks:	up to 30th harmonic: 1 % of setting value or 0.005 $I_{L\text{-}0}$ up to 50th harmonic, $f_{\text{min}} = 50$ Hz: 3 % of setting value or 0.02 $I_{L\text{-}0}$ up to 50th harmonic, $f_{\text{min}} = 60$ Hz: 4 % of setting value or 0.02 $I_{L\text{-}0}$
1.4.5.2 Pickup values V2	
Test condition:	0.300 V ; threshold value = 200.000V
Test values:	0.300 V ; threshold value = 200.000V
Permissive tolerance/limiting values:	In the range $I_{L\text{-}0} \pm 10$ % 0.5 % of setting value or 0.05 V

Summary

Test results/Remarks:	In the range $I_{L\text{-}0} \pm 10$ % 0.5 % of setting value or 0.05 V
1.4.5.3 Dropout ratio	
Test condition:	0.030 $I_{L\text{-}0}$; threshold value = 35.000 $I_{L\text{-}0}$ 0.300 V ; threshold value = 200.000V
Test values:	0.80 ; $r = 0.99$
Permissive tolerance/limiting values:	1 % of dropout value
Test results/Remarks:	1 % of dropout value
1.4.5.4 Pickup values Vphi-ph, V-sag-In	
Test condition:	0.300 V ; threshold value = 175.000V
Test values:	0.300 V ; threshold value = 175.000V
Permissive tolerance/limiting values:	In the range $I_{L\text{-}0} \pm 10$ % 0.5 % of setting value or 0.05 V
Test results/Remarks:	In the range $I_{L\text{-}0} \pm 10$ % 0.5 % of setting value or 0.05 V
1.4.5.5 Dropout ratio of V-sag-In	
Test condition:	0.300 V ; threshold value = 175.000V
Test values:	1.01 ; $r = 1.20$
Permissive tolerance/limiting values:	1 % of dropout value
Test results/Remarks:	1 % of dropout value
1.4.5.6 Pickup time	
Test condition:	see item 1.4.5.1
Test values:	1.2*threshold
Permissive tolerance/limiting values:	1 approx. 30 ms + OOT at 50 Hz 25 ms + OOT at 60 Hz
Test results/Remarks:	1 approx. 30 ms + OOT at 50 Hz 25 ms + OOT at 60 Hz
1.4.5.7 Dropout times	
Test condition:	see item 1.4.5.1
Permissive tolerance/limiting values:	1 approx. 20 ms + OOT

Summary

Test results/Remarks:	1 approx. 20 ms + OOT
1.4.5.8 Operate delays	
Test condition:	$I_{L\text{-}0}$ value
Test values:	0.00 s ; $T \leq 80.00$ s
Permissive tolerance/limiting values:	1 % of setting value or 10 ms
Test results/Remarks:	1 % of setting value or 10 ms
1.4.5.9 Duration of V-sag-in time	
Test condition:	$I_{L\text{-}0}$ value
Test values:	0.10 s ; $T \leq 80.00$ s
Permissive tolerance/limiting values:	1 % of setting value or 10 ms
Test results/Remarks:	1 % of setting value or 10 ms

ВЪРНО С
ОРИГИНАЛ



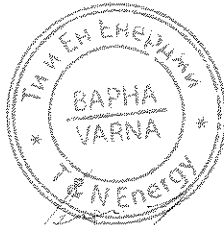
Summary

1.5 67 Directional Overcurrent Protection, Phases	
1.5.1 Specifications	<ul style="list-style-type: none"> - VDE 6435 - IEC/EN 60255-1, Part 7, Annex A, B - IEC/EN 60255-151
1.5.2 Directional overcurrent protection, phases with definite time overcurrent stages (definite time)	
1.5.2.1 Pickup values	
Test condition:	0.030 $I_{L\text{-}0}$; threshold value = 35.000 $I_{L\text{-}0}$ $f_{\text{min}} = 50$ Hz, 60 Hz
Method of measurement = fundamental components	
Permissive tolerance/limiting values:	1 % of setting value or 0.005 $I_{L\text{-}0}$
Test results/Remarks:	1 % of setting value or 0.005 $I_{L\text{-}0}$
Method of measurement = RMS value	
Permissive tolerance/limiting values:	up to 30th harmonic: 1 % of setting value or 0.005 $I_{L\text{-}0}$ up to 50th harmonic, $f_{\text{min}} = 50$ Hz: 3 % of setting value or 0.02 $I_{L\text{-}0}$ up to 50th harmonic, $f_{\text{min}} = 60$ Hz: 4 % of setting value or 0.02 $I_{L\text{-}0}$
Test results/Remarks:	up to 30th harmonic: 1 % of setting value or 0.005 $I_{L\text{-}0}$ up to 50th harmonic, $f_{\text{min}} = 50$ Hz: 3 % of setting value or 0.02 $I_{L\text{-}0}$ up to 50th harmonic, $f_{\text{min}} = 60$ Hz: 4 % of setting value or 0.02 $I_{L\text{-}0}$
1.5.2.2 Dropout ratio	
Test condition:	see item 1.5.2.1
Test values:	0.80 ; $r = 0.99$
Permissive tolerance/limiting values:	1 % of dropout value
Test results/Remarks:	1 % of dropout value
1.5.2.3 Pickup times	
Test condition:	see item 1.5.2.1 1.2*threshold
Permissive tolerance/limiting values:	1 approx. 25 ms + OOT at 50 Hz 22 ms + OOT at 60 Hz
Test results/Remarks:	1 approx. 25 ms + OOT at 50 Hz 22 ms + OOT at 60 Hz
1.5.2.4 Dropout times	
Test condition:	see item 1.5.2.1
Permissive tolerance/limiting values:	1 approx. 20 ms + OOT

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Summary

Test results/Remarks:	1 approx. 20 ms + OOT
1.5.2.5 Time delay	
Test condition:	see item 1.5.2.1 1.2* threshold
Test values:	0.60 s > T > 60.00 s
Permissive tolerance/Limiting values:	1 % of setting value or 10 ms
Test results/Remarks:	1 % of setting value or 10 ms
1.5.3 Directional overcurrent protection, phases with Inverse time overcurrent stage (Inverse time)	
1.5.3.1 Pickup values	
Test condition:	0.930 I _{set} > threshold value > 35.000 I _{pick} I _{pick} = 50 Hz, 60 Hz
Method of measurement = fundamental components:	
Permissive tolerance/Limiting values:	1 % of setting value or 0.005 I _{pick}
Test results/Remarks:	1 % of setting value or 0.005 I _{pick}
Method of measurement = RMS value:	
Permissive tolerance/Limiting values:	up to 30 th harmonics: 1 % of setting value or 0.005 I _{pick} up to 50th harmonic, I _{pick} = 50 Hz: 3 % of setting value or 0.02 I _{pick} up to 80th harmonic, I _{pick} = 60 Hz: 4 % of setting value or 0.02 I _{pick}
Test results/Remarks:	up to 30 th harmonics: 1 % of setting value or 0.005 I _{pick} up to 50th harmonic, I _{pick} = 50 Hz: 3 % of setting value or 0.02 I _{pick} up to 80th harmonic, I _{pick} = 60 Hz: 4 % of setting value or 0.02 I _{pick}
1.5.3.2 Dropout ratio	
Test condition:	see item 1.5.3.1
Instantaneous:	
Test values:	1.05 * threshold value 0.95 * pickup value
Disk emulation:	
Test values:	0.80 * threshold value
Permissive tolerance/Limiting values:	1 % of dropout value
Test results/Remarks:	1% of dropout value
1.5.3.3 Pickup times	
Test condition:	see item 1.5.3.1 1.2* threshold



ВЯРНО С
ОРИГИНАЛА

Summary

Permissive tolerance/Limiting values:	1 approx. 25 ms + OOT at 50 Hz 22 ms + OOT at 60 Hz
Test results/Remarks:	1 approx. 25 ms + OOT at 50 Hz 25 ms + OOT at 60 Hz
1.5.3.4 Dropout times	
Test condition:	see item 1.5.3.1
Permissive tolerance/Limiting values:	1 approx. 20 ms + OOT
Test results/Remarks:	1 approx. 20 ms + OOT
1.5.3.5 Tripping time characteristics	
Test condition:	see item 1.5.3.1 1.2* threshold
Test values:	Time dial: 0.05 > T > 15.00
Permissive tolerance/Limiting values:	5 % of setting value or ± 2 % of current tolerance or 10 ms
1.5.3.5.1 IEC normal Inverse (type A)	Test results/Remarks: 5 % of setting value or ± 2 % of current tolerance or 30 ms
1.5.3.5.2 IEC very Inverse (type B)	Test results/Remarks: 5 % of setting value or ± 2 % of current tolerance or 30 ms
1.5.3.5.3 IEC extremely Inverse (type C)	Test results/Remarks: 6 % of setting value or ± 2 % of current tolerance or 30 ms
1.5.3.5.4 IEC long-time Inverse (type B)	Test results/Remarks: 5 % of setting value or ± 2 % of current tolerance or 30 ms
1.5.3.5.5 ANSI long-time Inverse	Test results/Remarks: 5 % of setting value or ± 2 % of current tolerance or 30 ms
1.5.3.5.6 ANSI short-time Inverse	Test results/Remarks: 6 % of setting value or ± 2 % of current tolerance or 30 ms
1.5.3.5.7 ANSI extremely Inverse	Test results/Remarks: 5 % of setting value or ± 2 % of current tolerance or 30 ms
1.5.3.5.8 ANSI very Inverse	Test results/Remarks: 5 % of setting value or ± 2 % of current tolerance or 30 ms
1.5.3.5.9 ANSI normal Inverse	Test results/Remarks: 5 % of setting value or ± 2 % of current tolerance or 30 ms
1.5.3.5.10 ANSI moderately Inverse	Test results/Remarks: 5 % of setting value or ± 2 % of current tolerance or 30 ms

Summary

1.5.3.5.11 ANSI definite Inverse	Test results/Remarks: 5 % of setting value or ± 2 % of current tolerance or 30 ms
1.5.3.6 Dropout characteristics	
Test condition:	see item 1.5.3.1
Disk emulation:	0.8* threshold
Test values:	Time dial: 0.05 > T > 15.00
Permissive tolerance/Limiting values:	5 % of setting value or ± 2 % of current tolerance or 10 ms
1.5.3.6.1 IEC normal Inverse (type A)	Test results/Remarks: 5 % of setting value or ± 2 % of current tolerance or 30 ms
1.5.3.6.2 IEC very Inverse (type B)	Test results/Remarks: 5 % of setting value or ± 2 % of current tolerance or 30 ms
1.5.3.6.3 IEC extremely Inverse (type C)	Test results/Remarks: 5 % of setting value or ± 2 % of current tolerance or 30 ms
1.5.3.6.4 IEC long-time Inverse (type B)	Test results/Remarks: 5 % of setting value or ± 2 % of current tolerance or 30 ms
1.5.3.6.5 ANSI long-time Inverse	Test results/Remarks: 5 % of setting value or ± 2 % of current tolerance or 30 ms
1.5.3.6.6 ANSI short-time Inverse	Test results/Remarks: 5 % of setting value or ± 2 % of current tolerance or 30 ms
1.5.3.6.7 ANSI extremely Inverse	Test results/Remarks: 5 % of setting value or ± 2 % of current tolerance or 30 ms
1.5.3.6.8 ANSI very Inverse	Test results/Remarks: 5 % of setting value or ± 2 % of current tolerance or 30 ms
1.5.3.6.9 ANSI normal Inverse	Test results/Remarks: 5 % of setting value or ± 2 % of current tolerance or 30 ms
1.5.3.6.10 ANSI moderately Inverse	Test results/Remarks: 5 % of setting value or ± 2 % of current tolerance or 30 ms
1.5.3.6.11 ANSI definite Inverse	Test results/Remarks: 5 % of setting value or ± 2 % of current tolerance or 30 ms

Summary

1.5.4 Overcurrent protection, phases with user-defined characteristics	
1.5.4.1 Pickup	
Test condition:	0.930 I _{set} > threshold value > 35.000 I _{pick} I _{pick} = 50 Hz, 60 Hz
Method of measurement = fundamental components:	
Permissive tolerance/Limiting values:	1 % of setting value or 0.005 I _{pick}
Test results/Remarks:	1 % of setting value or 0.005 I _{pick}
Method of measurement = RMS value:	
Permissive tolerance/Limiting values:	up to 30 th harmonics: 1 % of setting value or 0.005 I _{pick} up to 50th harmonic, I _{pick} = 50 Hz: 3 % of setting value or 0.02 I _{pick} up to 80th harmonic, I _{pick} = 60 Hz: 4 % of setting value or 0.02 I _{pick}
Test results/Remarks:	up to 30 th harmonics: 1 % of setting value or 0.005 I _{pick} up to 50th harmonic, I _{pick} = 50 Hz: 3 % of setting value or 0.02 I _{pick} up to 80th harmonic, I _{pick} = 60 Hz: 4 % of setting value or 0.02 I _{pick}
1.5.4.2 Dropout ratio	
Test condition:	see item 1.5.4.1
Instantaneous:	
Test values:	1.05 * threshold value 0.95 * pickup value
Disk emulation:	
Test values:	0.80 * threshold value
Permissive tolerance/Limiting values:	1 % of dropout value
Test results/Remarks:	1% of dropout value
1.5.4.3 Pickup times	
Test condition:	see item 1.5.4.1 1.2* threshold
Permissive tolerance/Limiting values:	1 approx. 25 ms + OOT at 50 Hz 22 ms + OOT at 60 Hz
Test results/Remarks:	1 approx. 25 ms + OOT at 50 Hz 25 ms + OOT at 60 Hz
1.5.4.4 Dropout times	
Test condition:	see item 1.5.4.1
Permissive tolerance/Limiting values:	1 approx. 20 ms + OOT

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Summary

Test results/Remarks: 1 approx.
25 ms + OOT

1.5.4.5 Tripping time characteristics

Test condition: see item 1.5.4.1
1.2 threshold

Test values: Time dial: 0.05 s, T = 15.00

Permissive tolerance/Limiting values: 5 % of setting value or + 2 % of current tolerance or 10 ms

Test results/Remarks: 5 % of setting value or ± 2 % of current tolerance or 10 ms

1.5.4.6 Dropout characteristics

Test condition: see item 1.5.4.1

Disk emulation: 0.8 threshold

Test values: Time dial: 0.05 s, T = 15.00

Permissive tolerance/Limiting values: 5 % of setting value or + 2 % of current tolerance or 10 ms

Test results/Remarks: 5 % of setting value or ± 2 % of current tolerance or 10 ms

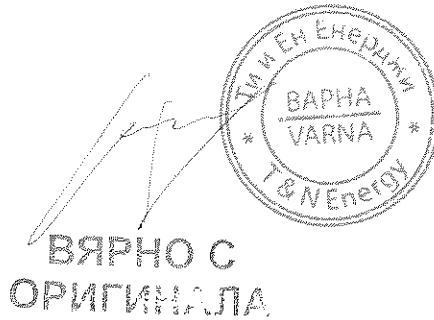
1.5.5 Directional determination

Test condition: 0.030 I_{load} > threshold value > 35.000 I_{load}
f_{load} = 60 Hz, 60 Hz

Test values: -180° - φ - 180°

Permissive tolerance/Limiting values: 1'

Test results/Remarks: 4'



Summary

Test results/Remarks: 1 approx.
30 ms + OOT at 50 Hz
25 ms + OOT at 60 Hz

1.8.2.4 Dropout times

Test condition: see item 1.8.2.1

Test values: see item 1.8.2.3

Permissive tolerance/Limiting values: 1 approx. 20 ms + OOT

Test results/Remarks: 1 approx. 20 ms + OOT

1.8.2.5 Time delays

Test condition: added to the inherent operating times

Test values: 0.00 s ; T : 60.00 s

Permissive tolerance/Limiting values: |N| : 1 % of setting value or 10 ms

Test results/Remarks: |N| : 1 % of setting value or 10 ms

1.8.3 Overcurrent Protection, 3I0 with inverse time overcurrent stage (inverse time)

1.8.3.1 Pickup values

Test condition: 0.030 I_{load} > 3I0 > 35.000 I_{load}
Time dial: 0.05 s, T = 15.00

Test values: I_{load} = 60 Hz, 60 Hz
0.030 I_{load} > 3I0 > 20.000 I_{load}

Method of measurement = fundamental components:

Permissive tolerance/Limiting values: |N| : 1 % of setting value or 0.005 I_{load}

Test results/Remarks: |N| : 1 % of setting value or 0.005 I_{load}

Method of measurement = RMS value:

Permissive tolerance/Limiting values: up to 30th harmonics: |N| : 1 % of setting value or 0.005 I_{load}
up to 50th harmonic, f_{load} = 50 Hz: |N| : 3 % of setting value or 0.02 I_{load}
up to 50th harmonic, f_{load} = 60 Hz: |N| : 4 % of setting value or 0.02 I_{load}

Test results/Remarks: up to 30th harmonics: |N| : 1 % of setting value or 0.005 I_{load}
up to 50th harmonic, f_{load} = 60 Hz: |N| : 3 % of setting value or 0.02 I_{load}
up to 50th harmonic, f_{load} = 60 Hz: |N| : 4 % of setting value or 0.02 I_{load}



Summary

1.6 67 Directional Overcurrent Protection, Ground

1.6.1 Specifications

- VDE 0435
- IEC/EN 60255-1, Item 7, Annex A, B
- IEC/EN 60255-151

1.6.2 Overcurrent Protection, 3I0 with definite time overcurrent stages (definite time)

1.6.2.1 Pickup values

Test condition: 0.030 I_{load} > 3I0 > 35.000 I_{load}

Test values: f_{load} = 50 Hz, 60 Hz
0.030 I_{load} > 3I0 > 20.000 I_{load}

Method of measurement = fundamental components:

Permissive tolerance/Limiting values: |N| : 1 % of setting value or 0.005 I_{load}

Test results/Remarks: |N| : 1 % of setting value or 0.005 I_{load}

Method of measurement = RMS value:

Permissive tolerance/Limiting values: up to 30th harmonics: |N| : 1 % of setting value or 0.005 I_{load}
up to 50th harmonic, f_{load} = 50 Hz: |N| : 3 % of setting value or 0.02 I_{load}
up to 50th harmonic, f_{load} = 60 Hz: |N| : 4 % of setting value or 0.02 I_{load}

Test results/Remarks: up to 30th harmonics: |N| : 1 % of setting value or 0.005 I_{load}
up to 50th harmonic, f_{load} = 50 Hz: |N| : 3 % of setting value or 0.02 I_{load}
up to 50th harmonic, f_{load} = 60 Hz: |N| : 4 % of setting value or 0.02 I_{load}

1.6.2.2 Dropout ratio

Test condition: see item 1.6.2.1

Test values: r = settable dropout ratio

Permissive tolerance/Limiting values: 0.00 - r : 0.99 for I ≥ 0.5 I_{rated}

Test results/Remarks: 0.00 - r : 0.99 for I ≥ 0.5 I_{rated}

1.6.2.3 Pickup times

Test condition: see item 1.6.2.1

Test values: 3I0/I_{rated} = 2

Permissive tolerance/Limiting values: 1 approx.
30 ms + OOT at 50 Hz
25 ms + OOT at 60 Hz

Summary

1.8.3.2 Dropout ratio

Test condition: see item 1.8.3.1

Instantaneous:

Test values: see item 1.8.3.1

Permissive tolerance/Limiting values: approx. 1.05 * threshold value
approx. 0.95 * pickup value

Test results/Remarks: approx. 1.05 * threshold value
approx. 0.95 * pickup value

Disk emulation

Test values: dropout time for 3I0I-threshold value ≤ 0.60

Permissive tolerance/Limiting values: approx. 0.90 * threshold value

Test results/Remarks: approx. 0.90 * threshold value

1.8.3.3 Pickup times

Test condition: see item 1.8.3.1

Test values: pickup time for 2.5 3I0I-threshold value ≤ 20

Permissive tolerance/Limiting values: 5 % of set point value or +2 % current tolerance or 30 ms

Test results/Remarks: 5 % of set point value or +2 % current tolerance or 30 ms

1.8.3.4 Dropout times

Test condition: see item 1.8.3.1

Instantaneous:

Test values: see item 1.8.3.1

Permissive tolerance/Limiting values: 1 approx. 20 ms + OOT

Test results/Remarks: 1 approx. 20 ms + OOT

Disk emulation

Test values: dropout time for 3I0I-threshold value ≤ 0.50

Permissive tolerance/Limiting values: 5 % of set point value or +2 % current tolerance or 30 ms



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Summary

Test results/Remarks:	5 % of set point value or +2 % current tolerance or 30 ms
1.8.3.5 Tripping time characteristics	
Test condition:	see item 1.8.3.1
Test values:	tripping times tk
Permissible tolerance/limiting values:	$ k \leq 5\% \pm 15\text{ ms}$ for $2 \leq 300\% I_{set}$
1.8.3.5.1 IEC normal Inverse (type A)	
Test results/Remarks:	$ k \geq 5\% \pm 15\text{ ms}$ for $2 \leq 300\% I_{set}$
1.8.3.5.2 IEC very Inverse (type B)	
Test results/Remarks:	$ k \geq 5\% \pm 15\text{ ms}$ for $2 \leq 300\% I_{set}$
1.8.3.5.3 IEC extremely Inverse (type C)	
Test results/Remarks:	$ k \geq 5\% \pm 15\text{ ms}$ for $2 \leq 300\% I_{set}$
1.8.3.5.4 IEC long-time Inverse (type B)	
Test results/Remarks:	$ k \geq 5\% \pm 15\text{ ms}$ for $2 \leq 300\% I_{set}$
1.8.3.5.5 ANSI long-time Inverse	
Test results/Remarks:	$ k \geq 5\% \pm 15\text{ ms}$ for $2 \leq 300\% I_{set}$
1.8.3.5.6 ANSI short-time Inverse	
Test results/Remarks:	$ k \geq 5\% \pm 15\text{ ms}$ for $2 \leq 300\% I_{set}$
1.8.3.5.7 IEC extremely Inverse	
Test results/Remarks:	$ k \geq 5\% \pm 15\text{ ms}$ for $2 \leq 300\% I_{set}$
1.8.3.5.8 ANSI very Inverse	
Test results/Remarks:	$ k \geq 5\% \pm 15\text{ ms}$ for $2 \leq 300\% I_{set}$
1.8.3.5.9 ANSI normal Inverse	
Test results/Remarks:	$ k \geq 5\% \pm 15\text{ ms}$ for $2 \leq 300\% I_{set}$
1.8.3.5.10 ANSI moderately Inverse	
Test results/Remarks:	$ k \geq 5\% \pm 15\text{ ms}$ for $2 \leq 300\% I_{set}$
1.8.3.5.11 ANSI definite Inverse	
Test results/Remarks:	$ k \geq 5\% \pm 15\text{ ms}$ for $2 \leq 300\% I_{set}$
1.8.3.8 Dropout characteristics	
Test condition:	see item 1.8.3.1
Test values:	dropout times
Permissible tolerance/limiting values:	$ k \leq 5\% \pm 30\text{ ms}$ for $0.05 \leq 300\% I_{set}$
1.8.3.6.1 IEC normal Inverse (type A)	
Test results/Remarks:	$ k \geq 5\% \pm 30\text{ ms}$ for $0.05 \leq 300\% I_{set}$

Summary

1.8.3.6.2 IEC very Inverse (type B)	
Test results/Remarks:	$ k \geq 5\% \pm 30\text{ ms}$ for $0.05 \leq 300\% I_{set}$
1.8.3.6.3 IEC extremely Inverse (type C)	
Test results/Remarks:	$ k \geq 5\% \pm 30\text{ ms}$ for $0.05 \leq 300\% I_{set}$
1.8.3.6.4 IEC long-time Inverse (type B)	
Test results/Remarks:	$ k \geq 5\% \pm 30\text{ ms}$ for $0.05 \leq 300\% I_{set}$
1.8.3.6.5 ANSI long-time Inverse	
Test results/Remarks:	$ k \geq 5\% \pm 30\text{ ms}$ for $0.05 \leq 300\% I_{set}$
1.8.3.6.6 ANSI short-time Inverse	
Test results/Remarks:	$ k \geq 5\% \pm 30\text{ ms}$ for $0.05 \leq 300\% I_{set}$
1.8.3.6.7 ANSI extremely Inverse	
Test results/Remarks:	$ k \geq 5\% \pm 30\text{ ms}$ for $0.05 \leq 300\% I_{set}$
1.8.3.6.8 ANSI very Inverse	
Test results/Remarks:	$ k \geq 5\% \pm 30\text{ ms}$ for $0.05 \leq 300\% I_{set}$
1.8.3.6.9 ANSI normal Inverse	
Test results/Remarks:	$ k \geq 5\% \pm 30\text{ ms}$ for $0.05 \leq 300\% I_{set}$
1.8.3.6.10 ANSI moderately Inverse	
Test results/Remarks:	$ k \geq 5\% \pm 30\text{ ms}$ for $0.05 \leq 300\% I_{set}$
1.8.3.6.11 ANSI definite Inverse	
Test results/Remarks:	$ k \geq 5\% \pm 30\text{ ms}$ for $0.05 \leq 300\% I_{set}$
1.8.4 Overcurrent Protection, 3I0 with user-defined characteristic	
1.8.4.1 Pickup	
Test condition:	0.030 I_{pick} \geq 3I0 \geq 35.000 I_{pick} Time dist. 0.05 s \leq T \leq 15.00
Test values:	I_{pick} = 50 Hz, 60 Hz 0.030 $I_{pick} \geq$ 3I0 \geq 18.000 I_{pick}
Method of measurement = fundamental components:	
Permissible tolerance/limiting values:	$ k \leq 1\%$ of setting value or 0.005 I_{pick}
Test results/Remarks:	$ k \leq 1\%$ of setting value or 0.005 I_{pick}
Method of measurement = RMS value:	
Permissible tolerance/limiting values:	up to 30 th harmonics: $ k \leq 1\%$ of setting value or 0.005 I_{pick} up to 60 th harmonic, f_{mod} = 50 Hz: $ k \leq 3\%$ of setting value or 0.02 I_{pick} up to 50 th harmonic, f_{mod} = 60 Hz: $ k \leq 4\%$ of setting value or 0.02 I_{pick}
Test results/Remarks:	up to 30 th harmonics: $ k \leq 1\%$ of setting value or 0.005 I_{pick}

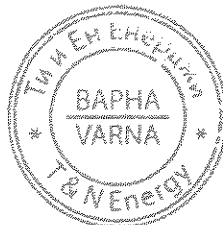
Summary

up to 50 th harmonic, f_{mod} = 50 Hz: $ k \leq 3\%$ of setting value or 0.02 I_{pick}	
up to 50 th harmonic, f_{mod} = 60 Hz: $ k \leq 4\%$ of setting value or 0.02 I_{pick}	
1.8.4.7 Dropout ratio	
Test condition:	see item 1.8.4.1
Test values:	see item 1.8.4.1
Permissible tolerance/limiting values:	approx. 1.05 * threshold value approx. 0.95 * pickup value
Test results/Remarks:	approx. 1.05 * threshold value approx. 0.95 * pickup value
Disk emulation	
Test values:	dropout time for 3I0I threshold value \leq 0.90
Permissible tolerance/limiting values:	approx. 0.90 * threshold value
Test results/Remarks:	approx. 0.90 * threshold value
1.8.4.3 Pickup times	
Test condition:	see item 1.8.4.1
Test values:	pickup time for 2 s $ k $ threshold value \leq 20
Permissible tolerance/limiting values:	5 % of set point value or +2 % current tolerance or 30 ms
Test results/Remarks:	5 % of set point value or +2 % current tolerance or 30 ms
1.8.4.4 Dropout times	
Test condition:	see item 1.8.4.1
Test values:	see item 1.8.4.3
Permissible tolerance/limiting values:	1 approx. 20 ms + OOT
Test results/Remarks:	1 approx. 20 ms + OOT
Disk emulation	
Test values:	dropout time for 3I threshold value \leq 0.90

Summary

Permissible tolerance/limiting values:	5 % of set point value or +2 % current tolerance or 30 ms
Test results/Remarks:	5 % of set point value or +2 % current tolerance or 30 ms
1.8.5 Overcurrent Protection, Logarithmic Inverse curve stage (Inverse time)	
1.8.5.1 Pickup values	
Test condition:	0.030 I_{pick} \geq 3I0 \geq 35.000 I_{pick}
Test values:	I_{pick} = 50 Hz, 60 Hz 0.030 $I_{pick} \geq$ 3I0 \geq 20.000 I_{pick}
Method of measurement = fundamental components:	
Permissible tolerance/limiting values:	$ k \leq 1\%$ of setting value or 0.005 I_{pick}
Test results/Remarks:	$ k \leq 1\%$ of setting value or 0.005 I_{pick}
Method of measurement = RMS value:	
Permissible tolerance/limiting values:	up to 30 th harmonics: $ k \leq 1\%$ of setting value or 0.005 I_{pick} up to 60 th harmonic, f_{mod} = 50 Hz: $ k \leq 3\%$ of setting value or 0.02 I_{pick} up to 50 th harmonic, f_{mod} = 60 Hz: $ k \leq 4\%$ of setting value or 0.02 I_{pick}
Test results/Remarks:	up to 30 th harmonics: $ k \leq 1\%$ of setting value or 0.005 I_{pick} up to 50 th harmonic, f_{mod} = 50 Hz: $ k \leq 3\%$ of setting value or 0.02 I_{pick} up to 50 th harmonic, f_{mod} = 60 Hz: $ k \leq 4\%$ of setting value or 0.02 I_{pick}
1.8.5.2 Dropout ratio	
Test condition:	see item 1.8.5.1
Test values:	see item 1.8.5.1
Permissible tolerance/limiting values:	approx. 1.05 * threshold value approx. 0.95 * pickup value
Test results/Remarks:	approx. 1.05 * threshold value approx. 0.95 * pickup value
1.8.5.3 Pickup times	
Test condition:	see item 1.8.5.1
Test values:	3I0 I_{pick} = 2
Permissible tolerance/limiting values:	1 approx. 35 ms + OOT at 50 Hz 32 ms + OOT at 60 Hz

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Summary

Test results/Remarks:	! approx. 30 ms + OOT at 50 Hz 25 ms + OOT at 60 Hz
1.6.5.4 Dropout times	
Test condition:	see item 1.6.5.1
Test values:	see item 1.6.5.3
Permissive tolerance/Limiting values:	! approx. 20 ms + OOT
Test results/Remarks:	! approx. 20 ms + OOT
1.6.5.5 Time delays	
Test condition:	added to the inherent operating times
Test values:	0.00 s ≤ T ≤ 60.00 s
Permissive tolerance/Limiting values:	t ≤ 5 % of setting value ± 15 ms
Test results/Remarks:	t ≤ 5 % of setting value or 15 ms
1.6.6 Overcurrent Protection, The logarithmic inverse time characteristic with knee point	
1.6.6.1 Pickup values	
Test condition:	f _{min} = 60 Hz, 60 Hz 0.030 I _{rated} ≤ I _{pick} ≤ 35.000 I _{rated}
Test values:	f _{min} = 60 Hz, 60 Hz 0.030 I _{rated} ≤ I _{pick} ≤ 20.000 I _{rated}
Method of measurement = fundamental components:	
Permissive tolerance/Limiting values:	t ≤ 1 % of setting value or 0.005 I _{rated}
Test results/Remarks:	t ≤ 1 % of setting value or 0.005 I _{rated}
Method of measurement = RMS value:	
Permissive tolerance/Limiting values:	up to 30 th harmonics: t ≤ 1 % of setting value or 0.005 I _{rated} up to 50th harmonic, f _{max} = 50 Hz: t ≤ 3 % of setting value or 0.02 I _{rated} up to 50th harmonic, f _{max} = 60 Hz: t ≤ 4 % of setting value or 0.02 I _{rated}
Test results/Remarks:	up to 30 th harmonics: t ≤ 1 % of setting value or 0.005 I _{rated} up to 50th harmonic, f _{max} = 50 Hz: t ≤ 3 % of setting value or 0.02 I _{rated} up to 50th harmonic, f _{max} = 60 Hz: t ≤ 4 % of setting value or 0.02 I _{rated}
1.6.6.2 Dropout ratio	
Test condition:	see item 1.6.6.1

Summary

Test values:	see item 1.6.6.1
Permissive tolerance/Limiting values:	approx. 0.95 * threshold value
Test results/Remarks:	approx. 0.65 * threshold value
1.6.6.3 Pickup times	
Test condition:	see item 1.6.6.1
Test values:	300 I _{rated} = 2
Permissive tolerance/Limiting values:	! approx. 35 ms + OOT at 50 Hz 32 ms + OOT at 60 Hz
Test results/Remarks:	! approx. 20 ms + OOT at 60 Hz 25 ms + OOT at 60 Hz
1.6.6.4 Dropout times	
Test condition:	see item 1.6.6.1
Test values:	see item 1.6.6.3
Permissive tolerance/Limiting values:	! approx. 20 ms + OOT
Test results/Remarks:	! approx. 20 ms + OOT
1.6.6.5 Time delays	
Test condition:	added to the inherent operating times
Test values:	0.00 s ≤ T ≤ 100.00 s
Permissive tolerance/Limiting values:	t ≤ 5 % of setting value ± 15 ms
Test results/Remarks:	t ≤ 5 % of setting value or 15 ms
1.6.7 Directional determination	
1.6.7.1 Rotation angle of reference voltage	
Test condition:	-180° ≤ Phi ≤ 180°
Test values:	various settings
Permissive tolerance/Limiting values:	t ≤ 1°
Test results/Remarks:	t ≤ 1°
1.6.7.2 Min. voltage V0 or V2	
Test condition:	0.15 V ≤ V0V2 ≤ 20.00 V
Test values:	various settings

Summary

Permissive tolerance/Limiting values:	t ≤ 1 %
Test results/Remarks:	t ≤ 1 %
1.6.7.3 Forward section +/-	
Test condition:	0° ≤ Phi ≤ 90°
Test values:	various settings
Permissive tolerance/Limiting values:	t ≤ 1°
Test results/Remarks:	t ≤ 1°
1.6.7.4 Polarization with	
Test condition:	- zero sequence - negative sequence
Test values:	various settings
Permissive tolerance/Limiting values:	function according to manual
Test results/Remarks:	function correct

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Summary

1.7 Inrush-Current Detection Specifications	
1.7.1	VDE 6435 IEC/EN 60255-1, item 7, Annex A, B
1.7.2 General test conditions	
f _{min}	50 Hz, 60 Hz
1.7.3 Operating-range limit I _{max}	
Test condition:	0.030 I _{rated} ≤ I _{max} ≤ 35.000 I _{rated}
Test values:	0.030 I _{rated} ≤ I _{max} ≤ 35.000 I _{rated}
Permissive tolerance/Limiting values:	t ≤ 1 % of setting value or 0.005 I _{rated}
Test results/Remarks:	t ≤ 1 % of setting value or 0.005 I _{rated}
1.7.4 Content of 2nd harmonics	
Test condition:	10 % ≤ I _{2nd} ≤ 45 %
Test values:	10 % ≤ I _{2nd} ≤ 45 %
Permissive tolerance/Limiting values:	t ≤ 1% of setting value
Test results/Remarks:	t ≤ 1% of setting value
1.7.5 Duration of the cross-blocking	
Test condition:	0.03 s ≤ T ≤ 200.00 s
Test values:	0.03 s ≤ T ≤ 200.00 s
Permissive tolerance/Limiting values:	t ≤ 1 % of setting value or 10 ms
Test results/Remarks:	t ≤ 1 % of setting value or 10 ms
1.7.6 Pickup times	
Permissive tolerance/Limiting values:	approx 20 ms + OOT
Test results/Remarks:	approx 20 ms + OOT
1.7.7 Dropout ratios	
1.7.7.1 Current measurement I _{max}	
Test condition:	r = 0.95 or 0.015 A at I _{rated} = 1 A r = 0.95 or 0.075 A at I _{rated} = 5 A
Permissive tolerance/Limiting values:	1% of the setting value or 5mA
Test results/Remarks:	1% of the setting value or 5mA

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Summary

1.7.2 Harmonics I2, Harm/1, Harm

Test condition: $r = 0.95$
 Permissible tolerance/Limiting values: 1% of the setting value for settings of t_{pickup} and $t_{release}$. Time delays
 Test results/Remarks: 1% of the setting value for settings of t_{pickup} and $t_{release}$. Time delays



Summary

1.8 50 High-Speed Instantaneous Overcurrent Protection
 1.8.1 Specifications

- VDE 0435
- IEC/EN 60255-1, item 7, Annex A, B
- IEC/EN 60255-151

1.8.2 General test conditions

rated 50 Hz, 60 Hz

1.8.3 Pickup values

Test condition: 0.030 I_{rated} ; I_p : 35.000 I_{rated}
 Test values: 0.100 I_{rated} ; I_p : 5.000 I_{rated}
 Permissible tolerance/Limiting values: |δ| ≤ 5 % of setting value or 0.010 I_{rated}
 Test results/Remarks: |δ| < 5 % of setting value or 0.010 I_{rated}

1.8.4 Dropout ratio

Test condition: see item 1.8.2
 Test values: r = settable dropout ratio
 0.50 ; r : 0.90

Permissible tolerance/Limiting values: |δ| ≤ 5 % of setting value
 Test results/Remarks: |δ| < 5 % of setting value

Pickup times

Test condition: current > 2x2 of threshold value
 Test values: t in ms

1.8.5 Permissible tolerance/Limiting values: t ≤ 8 ms + COT

Test results/Remarks: t < 8 ms + COT

Dropout times

Test condition: current change from > 2x2 to 0 of threshold value
 Test values: t in ms
 Test results/Remarks: t approx. 30 ms + COT

Summary

1.8 Arc Protection

1.8.1 General test conditions

rated 50 Hz, 60 Hz
 I_{rated} 1 A

1.8.2 Light only

1.8.2.1 Pickup time

Test condition: 100 measurements
 Pickup of stage measured with high-speed-relays
 Test results/Remarks: t_{max} = 3.6 ms
 t_{min} = 2.6 ms
 average = 3.0 ms

1.8.2.2 Dropout time

Test condition: 100 measurements
 Pickup of stage measured with high-speed-relays
 Test results/Remarks: t_{max} = 27.3 ms
 t_{min} = 26.7 ms
 average = 27.3 ms

1.8.3 Light and current

1.8.3.1 Threshold I_p

Test condition: 1pol-fault, 3pol-fault
 0.03 ; I_{rated}Obj = 10.00
 Permissible tolerance/Limiting values: no operate below threshold, measurement accuracy not considered
 Test results/Remarks: confirmed

1.8.3.2 Threshold 3I_D

Test condition: 1pol-fault, IN calculated, IN measured
 0.03 ; I_{rated}Obj = 10.00
 Permissible tolerance/Limiting values: no operate below threshold, measurement accuracy not considered
 Test results/Remarks: confirmed

1.8.3.3 Dropout ratio I_p

Test condition: 1pol-fault, 3pol-fault
 0.03 ; I_{rated}Obj = 10.00
 Permissible tolerance/Limiting values: approx. 0.00
 Test results/Remarks: 0.00 - 0.05

Summary

1.8.3.4 Dropout ratio 3I_D

Test condition: 1pol-fault
 0.03 ; I_{rated}Obj = 10.00
 Permissible tolerance/Limiting values: approx. 0.00
 Test results/Remarks: 0.00 - 0.05

1.8.3.5 Pickup time

Test condition: 100 measurements per fault type and frequency
 fault inception angle 10x(0°, 15°, 30°, ... 162°)
 Current jump from 1A to 10A at default threshold
 Pickup of stage measured with high-speed-relays
 Test results/Remarks:

	1pol, 50 Hz	1pol, 60 Hz	3pol, 50 Hz	3pol, 60 Hz
t _{max} =	9.2 ms	0.0 ms	6.9 ms	6.9 ms
t _{min} =	4.4 ms	3.6 ms	4.9 ms	3.8 ms
average =	4.4 ms	5.5 ms	5.3 ms	5.3 ms

1.8.3.6 Dropout time

Test condition: 100 measurements
 Current jump to 9 A
 Pickup of stage measured with high-speed-relays
 Test results/Remarks:

	1pol, 50 Hz	1pol, 60 Hz	3pol, 50 Hz	3pol, 60 Hz
t _{max} =	21.3 ms	27.5 ms	27.3 ms	27.8 ms
t _{min} =	26.7 ms	26.3 ms	26.2 ms	26.2 ms
average =	26.7 ms	27.2 ms	27.3 ms	27.2 ms

1.8.4 Frequency operating range

Test condition: I_{test} = 5 I_{rated} at default threshold, f = 6 Hz - 100 Hz
 Permissible tolerance/Limiting values: 10 Hz - 80 Hz
 Test results/Remarks: confirmed

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Summary

1.10.3.6.5 ANSI long-time Inverse	Test results/Remarks: $I_{th} \pm 5\% \pm 30$ ms for 0.05 $\cdot I_{th}$ \pm 0.90 $I_{th} \pm 5\% \pm 30$ ms for 0.05 $\cdot 300\% I_{th}$ \pm 0.90
1.10.3.6.6 ANSI short-time Inverse	Test results/Remarks: $I_{th} \pm 5\% \pm 30$ ms for 0.05 $\cdot I_{th}$ \pm 0.90 $I_{th} \pm 5\% \pm 30$ ms for 0.05 $\cdot 300\% I_{th}$ \pm 0.90
1.10.3.6.7 ANSI extremely Inverse	Test results/Remarks: $I_{th} \pm 5\% \pm 30$ ms for 0.05 $\cdot I_{th}$ \pm 0.90 $I_{th} \pm 5\% \pm 30$ ms for 0.05 $\cdot 300\% I_{th}$ \pm 0.90
1.10.3.6.8 ANSI very Inverse	Test results/Remarks: $I_{th} \pm 5\% \pm 30$ ms for 0.05 $\cdot I_{th}$ \pm 0.90 $I_{th} \pm 5\% \pm 30$ ms for 0.05 $\cdot 300\% I_{th}$ \pm 0.90
1.10.3.6.9 ANSI normal Inverse	Test results/Remarks: $I_{th} \pm 5\% \pm 30$ ms for 0.05 $\cdot I_{th}$ \pm 0.90 $I_{th} \pm 5\% \pm 30$ ms for 0.05 $\cdot 300\% I_{th}$ \pm 0.90
1.10.3.8.10 ANSI moderately Inverse	Test results/Remarks: $I_{th} \pm 5\% \pm 30$ ms for 0.05 $\cdot I_{th}$ \pm 0.90 $I_{th} \pm 5\% \pm 30$ ms for 0.05 $\cdot 300\% I_{th}$ \pm 0.90
1.10.3.8.11 ANSI definite Inverse	Test results/Remarks: $I_{th} \pm 5\% \pm 30$ ms for 0.05 $\cdot I_{th}$ \pm 0.90 $I_{th} \pm 5\% \pm 30$ ms for 0.05 $\cdot 300\% I_{th}$ \pm 0.90
1.10.4 Overcurrent Protection, 1-ph with user-defined characteristic curve stage	
1.10.4.1 Pickup	Test condition: $0.030 I_{load} > I_p > 35.000 I_{load}$ for CT protection $0.001 I_{load} > I_p > 1.800 I_{load}$ for CT sensitive Time dial: $0.05 \pm T \pm 15.00$ Test values: $f_{rated} = 60$ Hz, 60 Hz $0.030 I_{load} > I_p > 35.000 I_{load}$ for CT protection Method of measurement = fundamental components: Permissive tolerance/Limiting values: $I_{th} \pm 1\%$ of setting value or 0.005 I_{load} Test results/Remarks: $I_{th} < 1\%$ or 0.5 % I_{load} Method of measurement = RMS value: Permissive tolerance/Limiting values: up to 30 th harmonic: $I_{th} \pm 1\%$ of setting value or 0.005 I_{load} up to 80 th harmonic, $f_{rated} = 60$ Hz: $I_{th} \pm 3\%$ of setting value or 0.02 I_{load} up to 50 th harmonic, $f_{rated} = 60$ Hz: $I_{th} \pm 4\%$ of setting value or 0.02 I_{load} Test results/Remarks: up to 30 th harmonic: $I_{th} \pm 1\%$ of setting value or 0.005 I_{load} up to 80 th harmonic, $f_{rated} = 60$ Hz: $I_{th} \pm 3\%$ of setting value or 0.02 I_{load} up to 50 th harmonic, $f_{rated} = 60$ Hz: $I_{th} \pm 4\%$ of setting value or 0.02 I_{load}
1.10.4.2 Dropout ratios	Test condition: see item 1.10.4.1

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Permissive tolerance/Limiting values:	$I_{th} \pm 5\%$ of setting value or 0.01 I_{load}
Test results/Remarks:	$I_{th} \pm 5\%$ or 0.01 I_{load}
1.10.5.2 Dropout ratio	Test values: $r =$ adjustable dropout ratio Permissive tolerance/Limiting values: 0.60 \pm 0.09 Test results/Remarks: confirmed
1.10.5.3 Pickup times	Test values: $U_{pickup} = 2$ $I_{pickup} = 50$ Hz, 60 Hz Permissive tolerance/Limiting values: t approx. 8 ms + OOT at 50 Hz / 60 Hz Test results/Remarks: t approx. 8 ms + OOT at 50 Hz / 60 Hz
1.10.5.4 Dropout times	Test condition: see item 1.10.5.1 Test values: see item 1.10.5.1 Permissive tolerance/Limiting values: t approx. 25 ms + OOT Test results/Remarks: t approx. 25 ms + OOT
1.10.5.5 Time delays	Test condition: added to inherent operating times Test values: 0.60 s \pm $T_{op} > 60.00$ s Permissive tolerance/Limiting values: $I_{th} \pm 1\%$ of setting value or 10 ms Test results/Remarks: $I_{th} < 1\%$ of setting value or 10 ms



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Summary

Test values:	see item 1.10.4.1
Instantaneous:	
Permissive tolerance/Limiting values:	approx. 1.05 * threshold value approx. 0.95 * pickup value
Test results/Remarks:	approx. 1.05 * threshold value approx. 0.95 * pickup value
Disk emulation	
Permissive tolerance/Limiting values:	approx. 0.90 * threshold value
Test results/Remarks:	approx. 0.90 * threshold value
1.10.4.3 Pickup times	Test values: pickup time for 2.5 * threshold value \leq 20 Permissive tolerance/Limiting values: t approx. 25 ms + OOT at 60 Hz 22 ms + OOT at 60 Hz Test results/Remarks: t approx. 25 ms + OOT at 60 Hz 22 ms + OOT at 60 Hz
1.10.4.4 Dropout times	Instantaneous: Permissive tolerance/Limiting values: t approx. 20 ms + OOT Test results/Remarks: t approx. 20 ms + OOT Disk emulation: Test values: dropout time for 0.1 * threshold value \leq 90 Permissive tolerance/Limiting values: 5 % of set point value or +2 % current tolerance or 30 ms Test results/Remarks: 5 % of set point value or +2 % current tolerance or 30 ms
1.10.5 Overcurrent Protection, 1-phase with fast stage	
1.10.5.1 Pickup	Test condition: $0.030 I_{load} > I_p > 35.000 I_{load}$ for CT protection $0.001 I_{load} > I_p > 1.800 I_{load}$ for CT sensitive Test values: $f_{rated} = 60$ Hz, 60 Hz $0.030 I_{load} > I_p > 35.000 I_{load}$ for CT protection $0.001 I_{load} > I_p > 1.800 I_{load}$ for CT sensitive

Summary

1.11 Non-Directional Intermittent-Ground-Fault-Protection	
1.11.1 Specifications	- VDE 0438 - IEC/EN 60255-1, Item 7, Annex A, B - IEC60255-151
1.11.2 Intermittent ground fault protection stage	
1.11.2.1 Pickup values 200	Test condition: Fundamental components, RMS values $0.030 I_{rated} > 3I_0 > 35.000 I_{rated}$ for CT protection $0.001 I_{rated} > 3I_0 > 1.800 I_{rated}$ for CT sensitive Test values: $I_{rated} = 60$ Hz, 60 Hz $0.030 I_{rated} > 3I_0 > 35.000 I_{rated}$ for CT protection $0.001 I_{rated} > 3I_0 > 1.800 I_{rated}$ for CT sensitive Permissive tolerance/Limiting values: For CT protection: $I_{th} \pm 1\%$ of setting value or 0.005 I_{rated} For CT sensitive: $I_{th} \pm 1\%$ of setting value or 0.001 I_{rated} Test results/Remarks: For CT protection: $I_{th} \pm 1\%$ of setting value or 0.005 I_{rated} For CT sensitive: $I_{th} \pm 1\%$ of setting value or 0.001 I_{rated}
1.11.2.2 Dropout ratio	Test condition: see item 1.11.2.1 Test values: see item 1.11.2.1 Permissive tolerance/Limiting values: approx. 0.95 Test results/Remarks: approx. 0.95 Pickup time Test condition: see item 1.11.2.1 Test values: $I_{rated} = 2$ Permissive tolerance/Limiting values: t approx. 25 ms + OOT at 60 Hz 23 ms + OOT at 60 Hz Test results/Remarks: t approx. 25 ms + OOT at 60 Hz 23 ms + OOT at 60 Hz
1.11.2.3 Dropout times	Test condition: see item 1.11.2.1

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Summary

Test values: see item 1.11.2.1

Permissive tolerance/limiting values: 1 approx.
25 ms + OOT at 50 Hz
22 ms + OOT at 60 Hz

Test results/Remarks: 1 approx.
25 ms + OOT at 50 Hz
22 ms + OOT at 60 Hz

Pickup extension time

Test condition: $0.00 \text{ s} \leq T \leq 10.00 \text{ s}$

Test values: $0.00 \text{ s} \leq T \leq 10.00 \text{ s}$

Permissive tolerance/limiting values: $|T| \leq 1\%$ of setting value or 10 ms

1.11.2.4 Test results/Remarks: $|T| \leq 1\%$ of setting value or 10 ms

Sum of extended pickup times

Test condition: $0.00 \text{ s} \leq T \leq 100.00 \text{ s}$

Test values: $0.00 \text{ s} \leq T \leq 100.00 \text{ s}$

Permissive tolerance/limiting values: $|T| \leq 1\%$ of setting value or 10 ms

Test results/Remarks: $|T| \leq 1\%$ of setting value or 10 ms

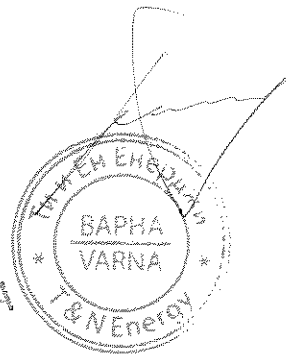
Reset time

Test condition: $0.00 \text{ s} \leq T \leq 600.00 \text{ s}$

Test values: $0.00 \text{ s} \leq T \leq 600.00 \text{ s}$

Permissive tolerance/limiting values: $|T| \leq 1\%$ of setting value or 10 ms

Test results/Remarks: $|T| \leq 1\%$ of setting value or 10 ms



Summary

1.12 Directional Intermittent Ground Fault Protection

1.12.1 Specifications

- VDE 0435
- IEC/EN 60255-1, Item 7, Annex A, B

1.12.2 Pickup values

Test condition: $0.030 I_{load} \leq 3I_0 < 35.000 I_{load}$ for CT type: protection
 $0.001 I_{load} \leq 3I_0 < 1.600 I_{load}$ for CT type: sensitive

Test values: $I_{load} = 1A, I_{load} = 50 \text{ Hz}$
 $0.030 I_{load} \leq 3I_0 < 35.000 I_{load}$ for CT type: protection
 $0.001 I_{load} \leq 3I_0 < 1.600 I_{load}$ for CT type: sensitive

Permissive tolerance/limiting values: For CT protection:
 $\leq 1\%$ of setting value or 0.5% of I_{load}
For CT sensitive:
 $\leq 1\%$ of setting value or 0.01% of I_{load}

Test results/Remarks: For CT protection:
 $\leq 1\%$ of setting value or 0.5% of I_{load}
For CT sensitive:
 $\leq 1\%$ of setting value or 0.01% of I_{load}

1.12.3 Dropout ratio

Test condition: see item 1.12.2

Test values: see item 1.12.2

Permissive tolerance/limiting values: approx. 0.85

Test results/Remarks: For CT protection:
 $\leq 1\%$ of setting value or 2% of I_{load}
For CT sensitive:
 $\leq 1\%$ of setting value or 0.08% of I_{load}

1.12.4 Pickup times

Test condition: see item 1.12.2

Test values: $W_{load} = 1.2$

Permissive tolerance/limiting values: 1 approx.
30 ms + OOT at $I_{load} = 50 \text{ Hz}$
23 ms + OOT at $I_{load} = 60 \text{ Hz}$

Test results/Remarks: 30 ms + OOT at $I_{load} = 50 \text{ Hz}$
23 ms + OOT at $I_{load} = 60 \text{ Hz}$

1.12.5 Dropout times

Test condition: see item 1.12.2

Summary

Permissive tolerance/limiting values: 1 approx.
25 ms + OOT at $I_{load} = 50 \text{ Hz}$
22 ms + OOT at $I_{load} = 60 \text{ Hz}$

Test results/Remarks: 25 ms + OOT at $I_{load} = 50 \text{ Hz}$
22 ms + OOT at $I_{load} = 60 \text{ Hz}$

1.12.6 Pickup extension time

Test condition: see item 1.12.2

Test values: $0.00 \text{ s} \leq T \leq 10.00 \text{ s}$

Permissive tolerance/limiting values: $\leq 1\%$ of setting value or 10 ms

Test results/Remarks: $\leq 1\%$ of setting value or 10 ms

1.12.7 Sum of extended pickup times

Test condition: see item 1.12.2

Test values: $0.00 \text{ s} \leq T \leq 100.00 \text{ s}$

Permissive tolerance/limiting values: $\leq 1\%$ of setting value or 10 ms

Test results/Remarks: $\leq 1\%$ of setting value or 10 ms

1.12.8 Reset time

Test condition: see item 1.12.2

Test values: $1.00 \text{ s} \leq T \leq 600.00 \text{ s}$

Permissive tolerance/limiting values: $\leq 1\%$ of setting value or 10 ms

Test results/Remarks: $\leq 1\%$ of setting value or 10 ms

Summary

1.13 51Ns Sensitive Ground Fault Protection

1.13.1 Specifications

- VDE 0435
- IEC/EN 60255-1, Item 7, Annex A, B

1.13.2 3I0

1.13.2.1 Pickup values

Test condition: $0.030 I_{load} \leq 3I_0 < 35.000 I_{load}$ for CT protection
 $0.001 I_{load} \leq 3I_0 < 1.600 I_{load}$ for CT sensitive

Test values: $I_{load} = 60 \text{ Hz}, 60 \text{ Hz}$
 $0.030 I_{load} \leq 3I_0 < 35.000 I_{load}$ for CT protection
 $0.001 I_{load} \leq 3I_0 < 1.600 I_{load}$ for CT sensitive

Permissive tolerance/limiting values: For CT protection:
 $|T| \leq 1\%$ of setting value or 0.5% of I_{load}
For CT sensitive:
 $|T| \leq 1\%$ of setting value or 0.01% of I_{load}

Test results/Remarks: For CT protection:
 $|T| \leq 1\%$ of setting value or 0.5% of I_{load}
For CT sensitive:
 $|T| \leq 1\%$ of setting value or 0.01% of I_{load}

1.13.2.2 Dropout ratio

Test condition: see item 1.13.2.1

Test values: see item 1.13.2.1

Permissive tolerance/limiting values: 0.85 (fixed)

Test results/Remarks: 0.85 (fixed)

1.13.2.3 Pickup times

Test condition: see item 1.13.2.1

Test values: $W_{load} = 2$

Permissive tolerance/limiting values: 1 approx.
25 ms + OOT at $I_{load} = 50 \text{ Hz}$
23 ms + OOT at $I_{load} = 60 \text{ Hz}$

Test results/Remarks: 1 approx.
25 ms + OOT at $I_{load} = 50 \text{ Hz}$
23 ms + OOT at $I_{load} = 60 \text{ Hz}$

1.13.2.4 Dropout times

Test condition: see item 1.13.2.1

Test values: see item 1.13.2.1

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Summary

Permissive tolerance/Limiting values: 1 approx.
25 ms + OOT at $f_{test} = 50$ Hz
22 ms + OOT at $f_{test} = 60$ Hz

Test results/Remarks: 1 approx.
25 ms + OOT at $f_{test} = 50$ Hz
22 ms + OOT at $f_{test} = 60$ Hz

1.13.2.5 Time delays

Test condition: added to the inherent operating times

Test values: $0.00 \text{ s} \leq T \leq 60.00 \text{ s}$

Permissive tolerance/Limiting values: $|t| \leq 1\%$ of setting value or 10 ms

Test results/Remarks: $|t| \leq 1\%$ of setting value or 10 ms

1.13.3 Admittance protection stage YD

1.13.3.1 Pickup values YD

Test condition: Fundamental components, RMS values
 $0.10 \text{ mS} \leq YD \leq 100.00 \text{ mS}$

Test values: $f_{test} = 60$ Hz, 50 Hz

Permissive tolerance/Limiting values: For CT protection:
 $|t| \leq 1\%$ of setting value or 1% of t_{pick}
For CT measurement:
 $|t| \leq 1\%$ of setting value or 0.1% of t_{pick}

Test results/Remarks: For CT protection:
 $|t| \leq 1\%$ of setting value or 1% of t_{pick}
For CT measurement:
 $|t| \leq 1\%$ of setting value or 0.1% of t_{pick}

1.13.3.2 Threshold values VD

Test condition: $0.300 \text{ V} \leq VD \leq 200.000 \text{ V}$

Test values: $0.300 \text{ V} \leq VD \leq 200.000 \text{ V}$

Permissive tolerance/Limiting values: $|t| \leq 1\%$ of setting value or 0.5 V

Test results/Remarks: $|t| \leq 1\%$ of setting value or 0.5 V

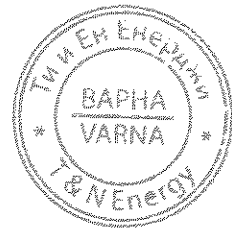
1.13.3.3 Pickup time

Test condition: see item 1.13.3.1

Test values: $I_{pick} = 2$

Permissive tolerance/Limiting values: 1 approx.
32 ms + OOT at 50 Hz
20 ms + OOT at 60 Hz

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Test results/Remarks: 1 approx.
32 ms + OOT at 50 Hz
20 ms + OOT at 60 Hz

1.13.3.4 Dropout times

Test condition: see item 1.13.3.1

Test values: see item 1.13.3.1

Permissive tolerance/Limiting values: 1 approx.
32 ms + OOT

Test results/Remarks: 1 approx.
32 ms + OOT

1.13.3.5 Time delays

Test condition: added to the inherent operating times

Test values: $0.00 \text{ s} \leq T \leq 60.00 \text{ s}$

Permissive tolerance/Limiting values: $|t| \leq 1\%$ of setting value or 10 ms

Test results/Remarks: $|t| \leq 1\%$ of setting value or 10 ms

Summary

1.14 67Ns Directional Sensitive Ground Fault Protection

1.14.1 Specifications

- VDE 0435
- IEC/EN 60255-1, Item 7, Annex A, B

1.14.1.3 3rd stage

1.14.2.1 Pickup values

Test condition: Fundamental components, RMS values
 $0.030 I_{pick} \leq 3I0 \leq 35.000 I_{pick}$ for CT protection
 $0.001 I_{pick} \leq 3I0 \leq 35.000 I_{pick}$ for CT sensitive

Test values: $f_{test} = 60$ Hz, 50 Hz
 $0.030 I_{pick} \leq 3I0 \leq 35.000 I_{pick}$ for CT protection

Permissive tolerance/Limiting values: For CT protection:
 $|t| \leq 1\%$ of setting value or 1% of t_{pick}
For CT measurement:
 $|t| \leq 1\%$ of setting value or 0.1% of t_{pick}

Test results/Remarks: $|t| \leq 1\%$

1.14.2.2 Dropout ratio

Test condition: see item 1.14.2.1

Test values: see item 1.14.2.1

Permissive tolerance/Limiting values: approx. 0.05

Test results/Remarks: 0.03...0.07

1.14.2.3 Pickup times

Test condition: see item 1.14.2.1

Test values: $I_{pick} = 2$

Permissive tolerance/Limiting values: 1 approx.
25 ms + OOT at $f_{test} = 50$ Hz
23 ms + OOT at $f_{test} = 60$ Hz

Test results/Remarks: 1 approx.
25 ms + OOT at $f_{test} = 50$ Hz
23 ms + OOT at $f_{test} = 60$ Hz

1.14.2.4 Dropout times

Test condition: see item 1.14.2.1

Test values: see item 1.14.2.1

Permissive tolerance/Limiting values: 1 approx.
25 ms + OOT

Test results/Remarks: 1 approx.
25 ms + OOT

Summary

1.14.2.5 Time delays

Test condition: added to the inherent operating times

Test values: $0.00 \text{ s} \leq T \leq 60.00 \text{ s}$

Permissive tolerance/Limiting values: $|t| \leq 1\%$ of setting value or 10 ms

Test results/Remarks: $|t| \leq 1\%$ or 10 ms

1.14.3 3I0 with cos φ- or sin φ-measurement stage

1.14.3.1 Pickup values 3I0

Test condition: Fundamental components, RMS values
 $0.030 I_{pick} \leq 3I0 \leq 35.000 I_{pick}$ for CT protection
 $0.001 I_{pick} \leq 3I0 \leq 35.000 I_{pick}$ for CT sensitive

Test values: $f_{test} = 60$ Hz, 50 Hz
 $0.030 I_{pick} \leq 3I0 \leq 35.000 I_{pick}$ for CT protection

Permissive tolerance/Limiting values: For CT protection:
 $|t| \leq 1\%$ of setting value or 1% of t_{pick}
For CT measurement:
 $|t| \leq 1\%$ of setting value or 0.1% of t_{pick}

Test results/Remarks: $|t| \leq 1\%$

1.14.3.2 Pickup values V0

Test condition: $f_{test} = 60$ Hz, 50 Hz
 $0.300 \text{ V} \leq VD \leq 200.000 \text{ V}$

Test values: $0.300 \text{ V} \leq VD \leq 200.000 \text{ V}$

Permissive tolerance/Limiting values: $|t| \leq 1\%$ of setting value or 0.05 V

Test results/Remarks: $|t| \leq 1\%$ or 0.05 V

1.14.3.3 Angle correction φ

Test condition: $-45^\circ \leq \varphi \leq 45^\circ$

Test values: $-45^\circ \leq \varphi \leq 45^\circ$

Permissive tolerance/Limiting values: $|t| \leq 1\%$ at $3I0 > 5 \text{ mA}$, $VD > 0.6 \text{ V}$

Test results/Remarks: $|t| \leq 1\%$ at $3I0 > 5 \text{ mA}$, $VD > 0.6 \text{ V}$

1.14.3.4 Dropout ratio

Test condition: see item 1.14.3.1 and 1.14.3.2

Test values: see item 1.14.3.1 and 1.14.3.2

Permissive tolerance/Limiting values: approx. 0.05

Summary

Test results/Remarks:	0.93...0.97
1.14.3.5 Pickup times	
Test condition:	see item 1.14.3.1 and 1.14.3.2
Test values:	$I_{pickup} = 2$
Permissive tolerance/limiting values:	1 approx. 32 ms + OOT at $f_{nom} = 50$ Hz 20 ms + OOT at $f_{nom} = 60$ Hz
Test results/Remarks:	1 approx. 32 ms + OOT at $f_{nom} = 60$ Hz 20 ms + OOT at $f_{nom} = 60$ Hz
1.14.3.6 Dropout times	
Test condition:	see item 1.14.3.1 and 1.14.3.2
Test values:	see item 1.14.3.1 and 1.14.3.2
Permissive tolerance/limiting values:	1 approx. 32 ms + OOT
Test results/Remarks:	1 approx. 32 ms + OOT
1.14.3.7 Time delays	
Test condition:	added to the inherent operating times
Test values:	$0.00 \text{ s} \leq T \leq 60.00 \text{ s}$
Permissive tolerance/limiting values:	$ N \leq 1\%$ from setting value or 10 ms
Test results/Remarks:	$ N \leq 1\%$ or 10 ms
1.14.4 3I0 with φ (V)-measurement stage	
1.14.4.1 Pickup values 3I0	
Test condition:	$f_{nom} = 50$ Hz, 60 Hz Fundamental components, RMS values $0.030 I_{nom} \leq 3I0 \leq 35.000 I_{nom}$ for CT protection $0.001 I_{nom} \leq 3I0 \leq 35.000 I_{nom}$ for CT sensitive
Test values:	$f_{nom} = 50$ Hz, 60 Hz $0.030 I_{nom} \leq 3I0 \leq 35.000 I_{nom}$ for CT protection
Permissive tolerance/limiting values:	For CT protection: $ N \leq 1\%$ from setting value or 1% of I_{nom} For CT measurement: $ N \leq 1\%$ from setting value or 0.1% of I_{nom}
Test results/Remarks:	$ N \leq 1\%$

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Summary

1.14.4.2 Pickup values V0	
Test condition:	$f_{nom} = 50$ Hz, 60 Hz $0.300 \text{ V} \leq V0 \leq 200.000 \text{ V}$
Test values:	$0.300 \text{ V} \leq V0 \leq 200.000 \text{ V}$
Permissive tolerance/limiting values:	$ N \leq 1\%$ from setting value or 0.05 V
Test results/Remarks:	$ N \leq 1\%$ or 0.05 V
1.14.4.3 Rotation angle of the reference voltage	
Test condition:	$-180^\circ \leq \varphi \leq 180^\circ$
Test values:	$-180^\circ \leq \varphi \leq 180^\circ$
Permissive tolerance/limiting values:	$ N \leq 1\%$ at $3I0 > 5 \text{ mA}$, $V0 \geq 0.6 \text{ V}$
Test results/Remarks:	$ N \leq 3\%$ at $3I0 > 2 \text{ mA}$, $V0 \geq 0.6 \text{ V}$ $ N \leq 2\%$ at $2 \text{ mA} < 3I0 < 10 \text{ mA}$, $V0 \geq 0.6 \text{ V}$ $ N \leq 1\%$ at $3I0 \geq 10 \text{ mA}$, $V0 \geq 0.6 \text{ V}$
1.14.4.4 Dropout ratio	
Test condition:	see item 1.14.4.1 and 1.14.4.2
Test values:	see item 1.14.4.1 and 1.14.4.2
Permissive tolerance/limiting values:	0.5% of dropout value or 15mA
Test results/Remarks:	0.5% of dropout value or 15mA
1.14.4.5 Pickup times	
Test condition:	see item 1.14.4.1 and 1.14.4.2
Test values:	1.2*threshold
Permissive tolerance/limiting values:	1 approx. 23 ms + OOT at $f_{nom} = 50$ Hz 21 ms + OOT at $f_{nom} = 60$ Hz
Test results/Remarks:	1 approx. 23 ms + OOT at $f_{nom} = 50$ Hz 21 ms + OOT at $f_{nom} = 60$ Hz
1.14.4.6 Dropout times	
Test condition:	see item 1.14.4.1 and 1.14.4.2
Permissive tolerance/limiting values:	1 approx. 21 ms + OOT at $f_{nom} = 50$ Hz 20 ms + OOT at $f_{nom} = 60$ Hz

Summary

Test results/Remarks:	1 approx. 21 ms + OOT at $f_{nom} = 50$ Hz 20 ms + OOT at $f_{nom} = 60$ Hz
1.14.4.7 Time delays	
Test condition:	see item 1.14.4.1 and 1.14.4.2
Test values:	1.2*threshold
Permissive tolerance/limiting values:	$\leq 1\%$ from setting value or 10 ms
Test results/Remarks:	$\geq 1\%$ of setting value or 10 ms
1.14.5 Overvoltage protection stage V0	
1.14.5.1 Pickup values	
Test condition:	$f_{nom} = 50$ Hz, 60 Hz Fundamental components, RMS values $0.300 \text{ V} \leq V0 \leq 200.000 \text{ V}$
Test values:	$0.300 \text{ V} \leq V0 \leq 200.000 \text{ V}$
Permissive tolerance/limiting values:	$ N \leq 0.5\%$ from setting value or 0.05 V
Test results/Remarks:	$ N \leq 0.5\%$ or 0.05 V
1.14.5.2 Dropout ratio	
Test condition:	$r =$ settable dropout ratio $0.60 \leq r \leq 0.80$
Test values:	$0.60 \leq r \leq 0.80$
Test results/Remarks:	$0.60 \leq r \leq 0.80$
1.14.5.3 Pickup times	
Test condition:	see item 1.14.5.1
Test values:	see item 1.14.5.1
Permissive tolerance/limiting values:	1 approx. RMS values, standard filter: 26 ms + OOT at $f_{nom} = 50$ Hz 22 ms + OOT at $f_{nom} = 60$ Hz Fundamental components, filter over 2 cycles: 45 ms + OOT at $f_{nom} = 50$ Hz 39 ms + OOT at $f_{nom} = 60$ Hz
Test results/Remarks:	1 approx. RMS values, standard filter: 26 ms + OOT at $f_{nom} = 50$ Hz 22 ms + OOT at $f_{nom} = 60$ Hz Fundamental components, filter over 2 cycles: 45 ms + OOT at $f_{nom} = 50$ Hz 39 ms + OOT at $f_{nom} = 60$ Hz

Summary

1.14.5.4 Dropout times	
Test condition:	see item 1.14.5.1
Test values:	see item 1.14.5.1
Permissive tolerance/limiting values:	1 approx. RMS values, standard filter: 21 ms + OOT Fundamental components, filter over 2 cycles: 30 ms + OOT
Test results/Remarks:	1 approx. RMS values, standard filter: 21 ms + OOT Fundamental components, filter over 2 cycles: 30 ms + OOT
1.14.5.5 Time delays	
Test condition:	added to the inherent operating times
Test values:	$0.00 \text{ s} \leq T \leq 60.00 \text{ s}$
Permissive tolerance/limiting values:	$ N \leq 1\%$ from setting value or 10 ms
Test results/Remarks:	$ N \leq 1\%$ or 10 ms
1.14.5.6 Transient ground fault protection stage	
1.14.5.1 Pickup values 3I0	
Test condition:	$f_{nom} = 50$ Hz, 60 Hz Fundamental components, RMS values $0.030 I_{nom} \leq 3I0 \leq 35.000 I_{nom}$ for CT protection $0.001 I_{nom} \leq 3I0 \leq 35.000 I_{nom}$ for CT sensitive
Test values:	$f_{nom} = 50$ Hz, 60 Hz $0.030 I_{nom} \leq 3I0 \leq 35.000 I_{nom}$ for CT protection
Permissive tolerance/limiting values:	For CT protection: $ N \leq 1\%$ from setting value or 1% of I_{nom} For CT measurement: $ N \leq 1\%$ from setting value or 0.1% of I_{nom}
Test results/Remarks:	For CT protection: $ N \leq 1\%$ from setting value or 1% of I_{nom} For CT measurement: $ N \leq 1\%$ from setting value or 0.1% of I_{nom}
1.14.5.2 Pickup values V0	
Test condition:	$f_{nom} = 50$ Hz, 60 Hz $0.300 \text{ V} \leq V0 \leq 200.000 \text{ V}$
Test values:	$0.300 \text{ V} \leq V0 \leq 200.000 \text{ V}$
Permissive tolerance/limiting values:	$ N \leq 1\%$ from setting value or 0.05 V
Test results/Remarks:	$ N \leq 1\%$ from setting value or 0.05 V

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Summary

1.14.6.3 Pickup times
 Test condition: see item 1.14.6.1 and 1.14.6.2
 Test values: $I_{load} = 2$
 Permissive tolerance/limiting values: 1 approx. 80 ms + OOT at $f_{test} = 60$ Hz
 85 ms + OOT at $f_{test} = 60$ Hz
 Test results/Remarks: 1 approx. 80 ms + OOT at $f_{test} = 50$ Hz
 85 ms + OOT at $f_{test} = 60$ Hz

1.14.6.4 Dropout times
 Test condition: see item 1.14.6.1 and 1.14.6.2
 Test values: see item 1.14.6.1 and 1.14.6.2
 Permissive tolerance/limiting values: 1 approx. 20 ms + OOT at $f_{test} = 60$ Hz
 15 ms + OOT at $f_{test} = 60$ Hz
 Test results/Remarks: 1 approx. 20 ms + OOT at $f_{test} = 60$ Hz
 15 ms + OOT at $f_{test} = 60$ Hz

1.14.6.5 Time delays
 Test condition: added to the inherent operating times
 Test values: 0.60 s $\leq T_s \leq$ 60.00 s
 Permissive tolerance/limiting values: $|N| \leq$ 1% from setting value or 10 ms
 Test results/Remarks: $|N| \leq$ 1% or 10 ms

1.14.7 Y0-with G0 or B0-measurement stage

1.14.7.1 Pickup values 3I0
 Test condition: Fundamental components, RMS values
 $0.030 I_{load} \leq 3I0 \leq 35.000 I_{load}$ for CT protection
 $0.001 I_{load} \leq 3I0 \leq 35.000 I_{load}$ for CT sensitive
 Test values: $f_{test} = 50$ Hz, 60 Hz
 $0.030 I_{load} \leq 3I0 \leq 35.000 I_{load}$ for CT protection
 Permissive tolerance/limiting values: For CT protection:
 $|N| \leq$ 1% from setting value or 1% of I_{load}
 For CT measurement:
 $|N| \leq$ 1% from setting value or 0.1% of I_{load}
 Test results/Remarks: For CT protection:
 $|N| \leq$ 1% from setting value or 1% of I_{load}
 For CT measurement:
 $|N| \leq$ 1% from setting value or 0.1% of I_{load}

1.14.7.2 Pickup values V0

Summary

Test condition: 0.300 V $\leq V0 \leq$ 200.000V
 Test values: 0.300 V $\leq V0 \leq$ 200.000V
 Permissive tolerance/limiting values: $|N| \leq$ 1% of setting value or 0.05 V
 Test results/Remarks: $|N| \leq$ 1% of setting value or 0.05 V

1.14.7.3 Angle correction φ
 Test condition: $-45^\circ \leq \varphi \leq 45^\circ$
 Test values: $-45^\circ \leq \varphi \leq 45^\circ$
 Permissive tolerance/limiting values: $|N| \leq$ 1' at $3I0 > 5$ mA, $V0 > 0.6$ V
 Test results/Remarks: $|N| \leq$ 1' at $3I0 > 5$ mA, $V0 > 0.6$ V

1.14.7.4 Pickup time
 Test condition: see item 1.14.7.1
 Test values: $I_{load} = 2$
 Permissive tolerance/limiting values: 1 approx. 32 ms + OOT at 50 Hz
 20 ms + OOT at 60 Hz
 Test results/Remarks: 1 approx. 32 ms + OOT at 50 Hz
 20 ms + OOT at 60 Hz

1.14.7.5 Dropout times
 Test condition: see item 1.14.7.1
 Test values: see item 1.14.7.1
 Permissive tolerance/limiting values: 1 approx. 32 ms + OOT at 50 Hz
 27 ms + OOT at 60 Hz
 Test results/Remarks: 1 approx. 32 ms + OOT at 50 Hz
 27 ms + OOT at 60 Hz

1.14.7.8 Time delays
 Test condition: added to the inherent operating times
 Test values: 0.00 s $\leq T_s \leq$ 60.00 s
 Permissive tolerance/limiting values: $|N| \leq$ 1% from setting value or 10 ms
 Test results/Remarks: $|N| \leq$ 1% from setting value or 10 ms

Summary

1.14.7.7 Polarized G0/B0 threshold
 Test condition: 0.10 mS $\leq Y0 \leq$ 100.00 mS
 Test values: 0.10 mS $\leq Y0 \leq$ 100.00 mS
 Permissive tolerance/limiting values: $|N| \leq$ 1% of setting value or 0.05 mS ($I_{load} = 1A/1.0A$) or 0.25 mS ($I_{load} = 5A/8A$)
 Test results/Remarks: $|N| \leq$ 1% of setting value or 0.05 mS ($I_{load} = 1A/1.0A$) or 0.25 mS ($I_{load} = 5A/8A$)

1.14.8 Admittance protection stage Y0
 1.14.8.1 Pickup values Y0
 Test condition: Fundamental components, RMS values
 0.10 mS $\leq Y0 \leq$ 100.00 mS
 Test values: $f_{test} = 50$ Hz, 60 Hz
 Permissive tolerance/limiting values: For CT protection:
 $|N| \leq$ 1% of setting value or 1% of I_{load}
 For CT measurement:
 $|N| \leq$ 1% of setting value or 0.1% of I_{load}
 Test results/Remarks: For CT protection:
 $|N| \leq$ 1% of setting value or 1% of I_{load}
 For CT measurement:
 $|N| \leq$ 1% of setting value or 0.1% of I_{load}

1.14.8.2 Threshold values V0
 Test condition: 0.300 V $\leq V0 \leq$ 200.000V
 Test values: 0.300 V $\leq V0 \leq$ 200.000V
 Permissive tolerance/limiting values: $|N| \leq$ 1% of setting value or 0.5 V
 Test results/Remarks: $|N| \leq$ 1% of setting value or 0.5 V

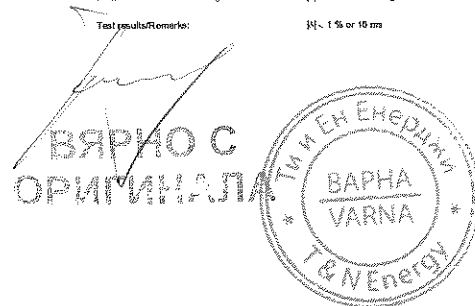
1.14.8.3 Pickup time
 Test condition: see item 1.14.8.1
 Test values: $I_{load} = 2$
 Permissive tolerance/limiting values: 1 approx. 32 ms + OOT at 50 Hz
 20 ms + OOT at 60 Hz
 Test results/Remarks: 1 approx. 32 ms + OOT at 50 Hz
 20 ms + OOT at 60 Hz

1.14.8.4 Dropout times
 Test condition: see item 1.14.8.1
 Test values: see item 1.14.8.1

Summary

Permissive tolerance/limiting values: 1 approx. 32 ms + OOT
 Test results/Remarks: 1 approx. 32 ms + OOT

1.14.8.5 Time delays
 Test condition: added to the inherent operating times
 Test values: 0.00 s $\leq T_s \leq$ 60.00 s
 Permissive tolerance/limiting values: $|N| \leq$ 1% from setting value or 10 ms
 Test results/Remarks: $|N| \leq$ 1% or 10 ms



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Summary

1.16 37 Undercurrent Protection with 3-phase
1.16.1 Specifications

- VDE 0435
- IEC/EN 60285-1, Item 7, Annex A, B
- IEC/EN 60285-151

1.16.2 Pickup values

Test condition: 0.030 $I_{load} > I_p > 36.000 I_{load}$
 Test values: $I_{load} = 50 \text{ Hz, } 60 \text{ Hz}$
 0.030 $I_{load} > I_p > 20.000 I_{load}$

Method of measurement = fundamental components:

Permissive tolerance/Limiting values: $|N| \leq 1\%$ of setting value or 0.005 I_{load}
 Test results/Remarks: $|N| \leq 2\%$ of setting value or 0.005 I_{load}

Method of measurement = R/S value:

Permissive tolerance/Limiting values: up to 30th harmonics; $|N| \leq 1\%$ of setting value or 0.005 I_{load}
 Test results/Remarks: up to 30th harmonics; $|N| \leq 2\%$ of setting value or 0.005 I_{load}

1.16.3 Dropout ratio

Test condition: see item 1.16.2
 Test values: see item 1.16.2
 Permissive tolerance/Limiting values: 1.05 (fixed)
 Test results/Remarks: 1.05 (fixed)

1.16.4 Pickup times

Test condition: see item 1.16.2
 Test values: $U_{load} = 1; U_{load} = 2$
 Permissive tolerance/Limiting values: t approx.
 25 ms + OOT at 50 Hz
 22 ms + OOT at 60 Hz
 Test results/Remarks: t approx.
 25 ms + OOT at 50 Hz
 22 ms + OOT at 60 Hz

1.16.5 Dropout times

Test condition: see item 1.16.2
 Test values: see item 1.16.2



Summary

1.16 46 Negative-Sequence Protection
1.16.1 Specifications

- VDE 0435
- IEC/EN 60285-1, Item 7, Annex A, B
- IEC/EN 60285-151

1.16.2 46 Negative-Sequence protection with definite time overcurrent stage

1.16.2.1 Pickup values

1.16.2.1.1 Reference value: rated current
 Test condition: 5.0 % $I_p > I_{load} > 999.9\%$
 Test values: various settings
 Permissive tolerance/Limiting values: $|N| \leq 2\%$ of setting value or 0.8 % absolute
 Test results/Remarks: $|N| < 2\%$ or 0.8 % absolute

1.16.2.1.2 Reference value: pos. seq. current

Test condition: 5.0 % $I_p > I_{load} > 999.9\%$
 Test values: various settings
 Permissive tolerance/Limiting values: $|N| \leq 2\%$ of setting value or 4 % absolute
 Test results/Remarks: $|N| < 2\%$ or 4 % absolute

1.16.2.2 Dropout ratio

Test condition: see item 1.16.2.1
 Test values: r = establish dropout ratio
 0.80 $\leq r \leq 0.90$
 Permissive tolerance/Limiting values: 0.80 $\leq r \leq 0.80$
 Test results/Remarks: 0.80 $\leq r \leq 0.80$

1.16.2.3 Pickup times

Test condition: see item 1.16.2.1
 Test values: $U_{load} = 1.2$
 Permissive tolerance/Limiting values: t approx.
 40 ms + OOT
 Test results/Remarks: t < 40 ms + OOT

1.16.2.4 Dropout times

Test condition: see item 1.16.2.1
 Test values: see item 1.16.2.3

Summary

Permissive tolerance/Limiting values: t approx.
 25 ms + OOT at 50 Hz
 22 ms + OOT at 60 Hz

Test results/Remarks: t approx.
 25 ms + OOT at 50 Hz
 22 ms + OOT at 60 Hz

1.16.8 Time delays

Test condition: added to the inherent operating times
 Test values: 0.000 s $\leq T_p \leq 60.000$ s
 Permissive tolerance/Limiting values: $|N| \leq 1\%$ of setting value or 10 ms
 Test results/Remarks: $|N| \leq 1\%$ of setting value or 10 ms

Summary

Permissive tolerance/Limiting values: t approx.
 35 ms + OOT
 Test results/Remarks: t < 35 ms + OOT

1.16.2.5 Time delays

Test condition: added to the inherent operating times
 Test values: 0.00 s $\leq T_p \leq 60.00$ s
 Permissive tolerance/Limiting values: $|N| \leq 1\%$ of setting value or 10 ms
 Test results/Remarks: $|N| \leq 1\%$ or 10 ms

1.16.3 46 Negative-Sequence protection with inverse time overcurrent stage

1.16.3.1 Pickup values

1.16.3.1.1 Reference value: rated current
 Test condition: 5.0 % $I_p > I_{load} > 999.9\%$
 Test values: various settings
 Permissive tolerance/Limiting values: $|N| \leq 2\%$ of setting value or 0.8 % absolute
 Test results/Remarks: $|N| < 2\%$ or 0.8 % absolute

1.16.3.1.2 Reference value: pos. seq. current

Test condition: 5.0 % $I_p > I_{load} > 999.9\%$
 Test values: various settings
 Permissive tolerance/Limiting values: $|N| \leq 2\%$ of setting value or 4 % absolute
 Test results/Remarks: $|N| < 2\%$ or 4 % absolute

1.16.3.2 Pickup times

Test condition: see item 1.16.3.1
 Test values: $U_{load} = 1.2$
 Permissive tolerance/Limiting values: t approx.
 40 ms + OOT
 Test results/Remarks: t < 40 ms + OOT

1.16.3.3 Dropout times

Test condition: see item 1.16.3.1
 Test values: see item 1.16.3.2
 Permissive tolerance/Limiting values: t approx.
 35 ms + OOT
 Test results/Remarks: t < 35 ms + OOT

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Summary

1.16.3.4	Tripping time characteristics	
Test condition:	see item 1.16.3.1	
Test values:	Time dist: 0.05 s, T ₁ 16.00	
Permissive tolerance/Limiting values:	5 % of setting value or ± 2 % of current tolerance or 30 ms	
1.16.3.4.1	IEC normal Inverse (type A)	5 % of setting value or ± 2 % of current tolerance or 30 ms
Test results/Remarks:		
1.16.3.4.2	IEC very Inverse (type B)	5 % of setting value or ± 2 % of current tolerance or 30 ms
Test results/Remarks:		
1.16.3.4.3	IEC extremely Inverse (type C)	5 % of setting value or ± 2 % of current tolerance or 30 ms
Test results/Remarks:		
1.16.3.4.4	IEC long-time Inverse (type B)	5 % of setting value or ± 2 % of current tolerance or 30 ms
Test results/Remarks:		
1.16.3.4.5	ANSI long-time Inverse	5 % of setting value or ± 2 % of current tolerance or 30 ms
Test results/Remarks:		
1.16.3.4.6	ANSI short-time Inverse	5 % of setting value or ± 2 % of current tolerance or 30 ms
Test results/Remarks:		
1.16.3.4.7	ANSI extremely Inverse	5 % of setting value or ± 2 % of current tolerance or 30 ms
Test results/Remarks:		
1.16.3.4.8	ANSI very Inverse	5 % of setting value or ± 2 % of current tolerance or 30 ms
Test results/Remarks:		
1.16.3.4.9	ANSI normal Inverse	5 % of setting value or ± 2 % of current tolerance or 30 ms
Test results/Remarks:		
1.16.3.4.10	ANSI moderately Inverse	5 % of setting value or ± 2 % of current tolerance or 30 ms
Test results/Remarks:		
1.16.3.4.11	ANSI definite Inverse	5 % of setting value or ± 2 % of current tolerance or 30 ms
Test results/Remarks:		
1.16.3.5	Dropout characteristics	
Test condition:	see item 1.16.3.1	
Dist. emulation:	< 0.8° threshold	
Test values:	Time dist: 0.05 s, T ₁ 16.00	
Permissive tolerance/Limiting values:	5 % of setting value or ± 2 % of current tolerance or 30 ms	
1.16.3.5.1	IEC normal Inverse (type A)	5 % of setting value or ± 2 % of current tolerance or 30 ms
Test results/Remarks:		
1.16.3.5.2	IEC very Inverse (type B)	5 % of setting value or ± 2 % of current tolerance or 30 ms
Test results/Remarks:		

Summary

1.16.3.5.3	IEC extremely Inverse (type C)	5 % of setting value or ± 2 % of current tolerance or 30 ms
Test results/Remarks:		
1.16.3.5.4	IEC long-time Inverse (type B)	5 % of setting value or ± 2 % of current tolerance or 30 ms
Test results/Remarks:		
1.16.3.5.5	ANSI long-time Inverse	5 % of setting value or ± 2 % of current tolerance or 30 ms
Test results/Remarks:		
1.16.3.5.6	ANSI short-time Inverse	5 % of setting value or ± 2 % of current tolerance or 30 ms
Test results/Remarks:		
1.16.3.5.7	ANSI extremely Inverse	5 % of setting value or ± 2 % of current tolerance or 30 ms
Test results/Remarks:		
1.16.3.5.8	ANSI very Inverse	5 % of setting value or ± 2 % of current tolerance or 30 ms
Test results/Remarks:		
1.16.3.5.9	ANSI normal Inverse	5 % of setting value or ± 2 % of current tolerance or 30 ms
Test results/Remarks:		
1.16.3.5.10	ANSI moderately Inverse	5 % of setting value or ± 2 % of current tolerance or 30 ms
Test results/Remarks:		
1.16.3.5.11	ANSI definite Inverse	5 % of setting value or ± 2 % of current tolerance or 30 ms
Test results/Remarks:		

Summary

1.17	48 Directional Negative-Sequence Protection with definite-time characteristic	
1.17.1	Specifications	
	- VDE 0436 - IECEN 60255-1, Item 7, Annex A, B - IECEN 60255-151	
1.17.2	Pickup values	
Test condition:	0.030 I _{red} > I ₀ 35.00 I _{nom}	
Permissive tolerance/Limiting values:	k ≥ 2 % of setting value or 10 mA	
Test results/Remarks:	k < 2 % or 0.8 % absolute	
1.17.3	Dropout ratio	
Test condition:	see item 1.17.2	
Permissive tolerance/Limiting values:	r approx. 0.65	
Test results/Remarks:	0.63 ≤ r ≤ 0.67	
1.17.4	Pickup times	
Test condition:	see item 1.17.2	
Permissive tolerance/Limiting values:	t approx. 40 ms + ODT	
Test results/Remarks:	t < 40 ms + ODT	
1.17.5	Dropout times	
Permissive tolerance/Limiting values:	t approx. 40 ms + ODT	
Test results/Remarks:	t < 39 ms + ODT	
1.17.6	Time delays	
Test condition:	added to the inherent operating times	
Test values:	0.60 s, T ₁ 60.00 s	
Permissive tolerance/Limiting values:	k ≥ 1 % of setting value or 10 ms	
Test results/Remarks:	k < 1 % or 10 ms	
1.17.7	Directional determination	
1.17.7.1	Angle forward α	
Test condition:	0° ≤ α ≤ 360°	
Test values:	various settings	
Permissive tolerance/Limiting values:	k ≥ 1°	

Summary

Test results/Remarks:	k < 1°
1.17.7.2	Angle reverse β
Test condition:	0° ≤ β ≤ 360°
Test values:	various settings
Permissive tolerance/Limiting values:	k ≥ 1°
Test results/Remarks:	k < 1°
1.17.7.3	Min. neg.-seq. voltage V2
Test condition:	0.15 V ≤ V ₂ ≤ 34.0 V
Test values:	various settings
Permissive tolerance/Limiting values:	k ≥ 1 %
Test results/Remarks:	k < 1 %
1.17.7.4	Minimum negative sequence current I2
Test condition:	0.030 A ≤ I ₂ ≤ 10.000 I _{nom}
Test values:	various settings
Permissive tolerance/Limiting values:	k ≥ 1 %
Test results/Remarks:	k < 1 %

Summary

1.18 49 Thermal Overload Protection 3phases	
1.18.1 Specifications	
- VDE 0435 - IECEN 60255-1, item 7, Annex A, B - IECEN 60255-8	
Test condition/Test values:	calculation method - OL calculation - Modus I _{max} = I _{max} - Modus I _{trip} = I _{trip}
Permissible tolerance/Limiting values:	k = Factor according to IEC 60255-8 or VDE 0435 T3011
1.18.2 Pickup threshold k * I_n	
Test condition:	k = I _{trip} /I _{nom} 0.10 ≤ k ≤ 4.00
Test values:	k = 0.10, 1.00, 4.00
<i>No filter applied</i>	
Permissible tolerance/Limiting values:	Up to 30th harmonic, 2% or 0.01 I _{nom} 2% class acc. to IEC60255-8 Up to 60th harmonic, I _{nom} = 60 Hz, 4% or 0.02 I _{nom} 4% class acc. to IEC60255-8 Up to 50th harmonic, I _{nom} = 60 Hz, 5% or 0.025 I _{nom} 5% class acc. to IEC60255-8
Test results/Remarks:	Up to 30th harmonic, 2% or 0.01 I _{nom} 2% class acc. to IEC60255-8 Up to 60th harmonic, I _{nom} = 60 Hz, 4% or 0.02 I _{nom} 4% class acc. to IEC60255-8 Up to 50th harmonic, I _{nom} = 60 Hz, 5% or 0.025 I _{nom} 5% class acc. to IEC60255-8
<i>With the filter for the compensation of the amplitude attenuation due to the non-linear</i>	
Permissible tolerance/Limiting values:	Up to 30th harmonic, 2% or 0.01 I _{nom} 2% class acc. to IEC60255-8 Up to 60th harmonic, I _{nom} = 60 Hz, 3% or 0.02 I _{nom} 4% class acc. to IEC60255-8 Up to 50th harmonic, I _{nom} = 60 Hz, 4% or 0.02 I _{nom} 5% class acc. to IEC60255-8
Test results/Remarks:	Up to 30th harmonic, 2% or 0.01 I _{nom} 2% class acc. to IEC60255-8 Up to 60th harmonic, I _{nom} = 60 Hz, 3% or 0.02 I _{nom} 4% class acc. to IEC60255-8 Up to 50th harmonic, I _{nom} = 60 Hz, 4% or 0.02 I _{nom} 5% class acc. to IEC60255-8
<i>With filter for the gain of harmonics including compensation of the amplitude attenuation¹</i>	
Permissible tolerance/Limiting values:	Up to 30th harmonic, 2% or 0.01 I _{nom} 2% class acc. to IEC60255-8 Up to 60th harmonic, I _{nom} = 60 Hz, 4% or 0.02 I _{nom} 4% class acc. to IEC60255-8 Up to 50th harmonic, I _{nom} = 60 Hz, 5% or 0.025 I _{nom} 5% class acc. to IEC60255-8
Test results/Remarks:	Up to 30th harmonic, 2% or 0.01 I _{nom} 2% class acc. to IEC60255-8 ² Up to 60th harmonic, I _{nom} = 60 Hz, 4% or 0.02 I _{nom} 4% class acc. to IEC60255-8 ³ Up to 50th harmonic, I _{nom} = 60 Hz, 5% or 0.025 I _{nom} 5% class acc. to IEC60255-8 ⁴
1.18.3 Thermal warning stage	
Test condition:	50 % ≤ I _{th-warn} ≤ 100 %

¹ In case that the filter response exactly matches the user defined gain factor
² In case that the user-defined gain factor is set below 3. The tolerance is amplified if the gain factor is larger
³ In case that the user-defined gain factor is set below 7. The tolerance is amplified if the gain factor is larger
⁴ In case that the user-defined gain factor is set below 7. The tolerance is amplified if the gain factor is larger

Summary

Test values:	60-warm = 50 %, 63 %, 60 %, 100 %
Test results/Remarks:	function correct
1.18.4 Current warning stage	
Test condition:	0.03 I _{nom} - I _{max} ≤ 35.000 I _{nom}
Test results/Remarks:	function correct
1.18.5 Dropout ratio	
Test condition:	dropout threshold ratio 60 % ≤ r ≤ 80 %
Test results/Remarks:	function correct
1.18.6 Tripping time characteristics	
1.18.6.1 Parameter k, τ	
Test condition:	k = I _{trip} /I _{nom} (IEC 60255-8) τ = Time constant
Test values:	tripping times t
Permissible tolerance/Limiting values:	t ≤ 3 % or 1 s 3 % class acc. to IEC 60255-8 for t(k * I _{nom}) > 1.25
1.18.6.2 Range of k, τ	
Test condition:	0.10 ≤ k ≤ 4.00 30 s ≤ τ ≤ 60000 s
Test values:	fault I-N, Modus I-max
Permissible tolerance/Limiting values:	t = 1/(1/(k * I _{nom}) ² * (I _{max} - I _{nom}) ²) + (I _{max} - I _{nom}) ² for t(k * I _{nom}) ≥ 8
1.18.6.3 With and without preload	
Test condition:	with and without preload
Test values:	a) k = 0.1; τ = (500, 500) min; I = 0.7 A b) k = 1.1; τ = (20, 100) min; I = 2.6 A c) k = 4.0; τ = (1, 5) min; I = 5.0 A d) k = 1.0; τ = (1, 3, 10) min; I = 1.0 A
1.18.6.4 Range t(k * I_{nom}) ≥ 8	
Test condition:	range t(k * I _{nom}) ≥ 8
Test values:	a) k = 1.0; t(k * I _{nom}) = 8, 10, 12 b) k = 0.1; t(k * I _{nom}) = 6, 10, 80
Permissible tolerance/Limiting values:	t ≤ 3 % or 1 s t = 1 according to formula for t(k * I _{nom}) ≥ 8
Test results/Remarks:	function correct

Summary

1.19 48 Thermal Overload Protection, User-Defined Characteristic Curve	
1.19.1 Specifications	
- VDE 0435 - IECEN 60255-1, item 7, Annex A, B - IECEN 60255-8	
1.19.2 Pickup threshold k * I_n	
Test condition:	k = I _{trip} /I _{nom} (I _{nom} = I _{LN} - 0.01, I _{LN} is the first point in user-defined curve)
Test values:	k = 0.71, 2
Permissible tolerance/Limiting values:	t ≤ 2 % or 10 mA at I _{trip} = 1 A t ≤ 2 % or 60 mA at I _{trip} = 5 A class 2 % acc. to IEC 60255-8
Test results/Remarks:	t ≤ 2 % or 10 mA at I _{trip} = 1 A t ≤ 2 % or 60 mA at I _{trip} = 5 A class 2 % acc. to IEC 60255-8
1.19.3 Thermal warning	
Test condition:	50 % ≤ I _{th-warn} ≤ 100 %
Test values:	I _{th-warn} = 50 %, 70 %, 90 %
Test results/Remarks:	function correct
1.19.4 Dropout threshold operate	
Test condition:	50 % ≤ I _{th-dropout op.} ≤ 80 %
Test values:	I _{th-dropout op.} = 80 %, 88 %
Test results/Remarks:	function correct
1.19.5 Current warning	
Test condition:	0.030 I _{nom} - I _{max} ≤ 35.000 I _{nom}
Test values:	I _{nom} = 50 Hz, 60 Hz 0.030 I _{nom} ≤ threshold value ≤ 35.000 I _{nom}
Permissible tolerance/Limiting values:	1 % of setting value or 0.005 I _{nom}
Test results/Remarks:	1 % of setting value or 0.005 I _{nom}
1.19.6 Dropout ratio I-warming	
Test condition:	see item 1.19.5
Test values:	r = 0.65
Permissible tolerance/Limiting values:	0.94 ≤ r ≤ 0.66 of threshold value or ≤ 0.020 A
Test results/Remarks:	0.94 ≤ r ≤ 0.66 of threshold value or ≤ 0.020 A

Summary

1.19.7 Emergency T overtravel	
Test condition:	Operate char. curve
Test values:	0.00 s ≤ T ₁ ≤ 15000 s
Permissible tolerance/Limiting values:	1 % of setting value or 20 ms
Test results/Remarks:	1 % of setting value or 20 ms
1.19.8 Preload	
Test condition:	0 % ≤ Preload ≤ 100 %
Test values:	Preload = 0 %, 80 %, 100 %
Permissible tolerance/Limiting values:	t ≤ 3 % or 1 s class 3 % acc. to IEC 60255-8 for t(k * I _{nom}) > 1.25
Test results/Remarks:	t ≤ 3 % or 1 s class 3 % acc. to IEC 60255-8 for t(k * I _{nom}) > 1.25
1.19.9 Tripping time characteristics	
Test condition:	Operate char. curve
Test values:	Tripping times t
Permissible tolerance/Limiting values:	t ≤ 3 % or 1 s class 3 % acc. to IEC 60255-8 for t(k * I _{nom}) > 1.25
Test results/Remarks:	t ≤ 3 % or 1 s class 3 % acc. to IEC 60255-8 for t(k * I _{nom}) > 1.25



GFF

Test Report

Test Report No.: TS0716-006
Date of issue: 2016-07-22

Subject:

Type test Bay Control SIPROTEC 5 - V07.30 / Edition 06

The tests were performed by:

SIEMENS AG
Development
EM DG PRO D PA DEV
Wernerwerkdam 5
D - 13829 Berlin

The tests were performed for:

SIEMENS AG
Products
EM DG PRO LM
Humboldtstr. 59
D - 90459 Nürnberg

Tested equipment: Multifunction Protection Relays SIPROTEC 6

Product group: Bay Control
6MD85, 6MD88

Firmware V07.30

Tests are according to: IEC/EN 60255, VDE 0435, IEC/EN 60870-2-1, UL 508
IEC/EN 60255-25/26, IEC/EN 61000-6-2, IEC/EN 61000-6-4,
IEEE Std C37.60.1/2

Performed tests: Properties at reference conditions

Test results: The equipment has successfully passed the type test. The equipment did not show any changes and was fully in order subsequent to these tests..

SIEMENS AG - EM DG PRO
Energy Management
Digital Grid

Place: EM DG PRO D
13829 Berlin (Stemensstadt)

Date: 2016-07-22

Tested by: Klausung

Reviewed by: Rochow

This test report consists of 86 pages.

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Version: 2.01

ВЪРХУ С
ОРИГИНАЛА

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Range of validity

SIPROTEC 5 Platform and Hardware Characteristics

The SIPROTEC 5 series includes both modular and non-modular devices.

Modular devices consist of a base module (1/3 of 19 inches) and can be expanded with expansion modules (1/6 of 19 inches). The device type identifier for modular devices is XXX85, XXX86 or XXX87, for example, 7SA86 Type XXX84 devices have the same hardware properties as the modular devices, but they cannot be expanded with expansion modules.

All non-modular devices consist of just a base module (1/3 of 19 inches) and cannot be expanded with expansion modules (1/6 of 19 inches). The device type identifier for non-modular devices is 7XX82, e.g., 7SJ82.

Hardware Characteristics of Modular Devices

A modular device always consists of a base module and optionally of expansion modules. The modules can be chosen according to hardware characteristics. These characteristics are:

- Module size
- Type of construction
- Mounting of the on-site operation panel
- Layout (or design) of the on-site operation panel
- Input and output module
- Plug-in modules

The modules are available in 2 sizes:

- Base module (1/3 of 19 in)
- Extension module (1/6 of 19 in)

The devices are available in 3 designs:

- Flush-mounting devices with on-site operation panel fitted directly on the device
- Surface-mounting devices with integrated on-site operation panel
- Surface-mounting devices with detached on-site operation panel

The on-site operation panels of the base modules can be selected from 3 variants:

- With a large display, keypad, and 16 2-colored LEDs
- With a small display, keypad, and 16 2-colored LEDs
- Without a display, without a keypad, but with 16 2-colored LEDs

The on-site operation panels of the extension modules can be selected from 4 variants:

- With 16 1-colored LEDs and 2 key switches
- With 16 1-colored LEDs
- With 8 push-buttons and 8 1-colored LEDs
- Without display elements

The base module always contains the power-supply module PS201 and an input and output module IO2XX.

The extension module contains an input and output module IO2XX or a plug-in module assembly with integrated power supply CB202.

The 1st extension module in the 2nd device row always contains power supply module PS203.

The plug-in modules are available for various applications. The following plug-in modules can be installed in the base module or in an extension module with plug-in module assembly with integrated power supply CB202:

- Communication module
- Measuring-transducer module

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Range of validity

Hardware Characteristics of Non-Modular Devices

A non-modular device always consists of just one module (1/3 of 19 inches) and cannot be expanded with expansion modules (1/6 of 19 inches). These hardware characteristics are:

- Module size: 1/3 of 19 in.
- Type of construction: Flush-mounting devices with on-site operation panel fitted directly on the device

The on-site operation panels can be chosen from 2 variants:

- With a large display, keypad, and 16 2-colored LEDs
- With a small display, keypad, and 16 2-colored LEDs

The module always contains the power supply module PS101 and an input and output module IO10X. The input and output module IO10X includes the terminals for current and voltage transformers. Optionally, the module can be equipped an additional input and output module IO110 for extra binary inputs and outputs. The plug-in modules are available for various applications. The following plug-in modules can be installed in the module:

- Communication modules
- Measuring-transducer modules

Range of validity

SIPROTEC 5 devices

All type tests were performed at various combinations of all modules of the SIPROTEC 5 platform. As a result the following devices were covered:

Model of Protective Relay	Trip Detection	Quantity structure
6MDB5	Bay Control	I/Os fully modular
6MD86	Bay Control	3-pole trip I/Os fully modular

Range of validity

SIPROTEC 5, functional description of power supply, CPU, IO boards and plug-in modules

All hardware type tests were performed at various combinations with all modules of the SIPROTEC 5 platform. As a result all realized devices were covered:

SIPROTEC 5

Functional description of boards for modular devices

Board name	Functional description
PS201	Power Supply Board (DC: 24 V/48 V or 60 V to 250 V and AC: 100 V to 230 V), mounted in 1/3 19-inch size housing, including 3 binary inputs, 2 binary outputs and one status life contact
PS203	Power Supply Board for the 2 nd row of devices, (DC: 24 V/48 V or 60 V to 250 V and AC: 100 V to 230 V), mounted in 1/6 19-inch size housing
CB202	Plug-in module assembly, including an additional power supply, (DC: 24 V/48 V or 60 V to 250 V and AC: 100 V to 230 V), mounted in 1/6 19-inch size housing
CP200/CP300	Processor (CPU) Board, mounted into the front cover of the 1/3 19-inch size housing, different variants for the available device designs
IO201	Input Output Board, 4 current inputs, 8 binary inputs, 6 binary outputs, reduced assembled variant of IO202
IO202	Input Output Board, 4 current measuring inputs, 4 voltage measuring inputs, 8 binary inputs, 6 binary outputs, mounted in 1/8 or 1/3 19-inch size housing
IO203	Input Output Board, 8 current measuring inputs, 4 binary inputs, 4 binary outputs, mounted in 1/8 19-inch size housing
IO204	Input Output Board, 10 binary inputs, 4 binary outputs, 4 power relays for controlling 2 motors, mounted in 1/6 19-inch size housing
IO205	Input Output Board, 12 binary inputs, 16 binary outputs, mounted in 1/6 19-inch size housing
IO206	Input Output Board, 6 binary inputs, 7 binary outputs, mounted in 1/6 19-inch size housing, reduced assembled variant of IO205
IO207	Input Output Board, 18 binary inputs, 8 binary outputs, mounted in 1/6 19-inch size housing
IO208	Input Output Board, 4 current measuring inputs, 4 voltage measuring inputs, 4 binary inputs, 11 binary outputs, mounted in 1/3 or 1/6 19-inch size housing
IO209	Input Output Board, 8 binary inputs, 4 High Speed Outputs, mounted in 1/6 19-inch size housing
IO210	Input Output Board, 4 current measuring inputs, 3 voltage measuring inputs, 7 binary outputs, 4 high-speed measuring-transducer inputs for current or voltage, mounted in 1/8 19-inch size housing
IO211	Input Output Board, 6 voltage measuring inputs, 8 binary inputs, mounted in 1/8 or 1/3 19-inch size housing
IO212	Input Output Board, 8 high-speed measuring-transducer inputs for current or voltage, 8 binary inputs, mounted in 1/8 19-inch size housing
IO214	Input Output Board, 4 current measuring inputs, 4 voltage measuring inputs, 2 binary in-puts, 5 binary outputs, mounted in 1/8 or 1/3 19-inch size housing, reduced assembled variant of IO202
IO215	Input Output Board, 4 current measuring inputs, 4 voltage measuring inputs (designed for a measuring range up to 7.07 V) 8 binary inputs, 6 binary outputs, mounted in 1/6 or 1/3 19-inch size housing
IO230	Input Board, 48 binary inputs, mounted in 1/6 19-inch size housing
IO231	Input Output Board, 24 binary inputs, 24 binary outputs, mounted in 1/6 19-inch size housing

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Range of validity

PB201	Process-Bus Module, 7 LC Duplex interfaces of which one is a service port, mounted in 1/6 19-inch size housing
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Range of validity

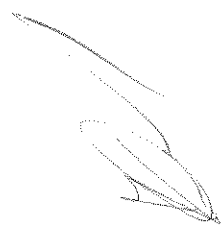
Functional description of boards for non-modular devices

Board name	Functional description
PS101	Power Supply Board (DC: 24 V/48 V or DC: 60 V to 125 V or DC: 110 V to 250 V and AC: 100 V to 230 V), including 3 binary inputs, 2 binary outputs and one status life contact
IO101	Input Output Board, 4 current inputs, 6 binary inputs, 6 binary outputs, reduced assembled variant of IO102
IO102	Input Output Board, 4 current inputs, 4 voltage inputs, 8 binary inputs, 6 binary outputs
IO103	Input Output Board, 8 current inputs, 4 binary inputs, 4 binary outputs
IO110	Input Output Board, 12 binary inputs, 7 binary outputs
CP100	Processor (CPU) Board, mounted into the front cover of the device

Functional description of plug-in modules for modular devices and for non-modular devices

USART-xx ¹ -y ² EL	Serial communication module, electrical connection
USART-xx ¹ -y ² FO	Serial communication module, optical connection
USART-xx ¹ -y ² LDFO	Serial communication module for long distances, optical connection
ETH-xx ¹ -2EL	Ethernet module, electrical connection
ETH-xx ¹ -2FO	Ethernet module, optical connection
ANAL-CA-4EL	Measuring-transducer module
ARC-CD-3FO ³	Arc Protection module

Valid for all firmware and DIGSI versions.



¹ xx: two letters, unique code for the module in the product code of the device
² y: 1 = 1 channel, 2 = 2 channels
³ Not available for Busbar Protection and Fault Recorder

Subcontracting

Testing laboratory

Marking



Scope of editions

Edition	Date	Modifications or supplements compared to the former edition
01	2012-03-02	First edition, Software V01.00
02	2013-12-09	Revision and extended at Software V04.00
03	2014-12-18	Revision and extended at Software V06.00
04	2015-05-05	Revision and extended at Software V06.20
05	2015-12-18	Revision and extended at Software V07.00
06	2016-07-22	Revision and extended at Software V07.30



Technical information; Technical Data

Technical information; Description:

Manual				Edition
1. SIPROTEC 5				
Protection Devices				
Product Information	Part No.	C53000-B6000-C001-B		German
		C53000-B5040-C001-B		English
2. SIPROTEC 5				
Hardware				
Manual	Part No.	C53000-G5000-C002-B		German
		C53000-G5040-C002-B		English
3. SIPROTEC 5				
Operating				
Manual	Part No.	C53000-G5000-C003-7		German
		C53000-G5040-C003-7		English
4. SIPROTEC 5				
High-Voltage Bay Controller: 6MD85/86				
Manual	Part No.	C53000-G5000-C015-8		German
		C53000-G5040-C015-8		English

For the Technical Data see the description (Technical Information).



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Summary

1 Properties at reference conditions

1.1 General
1.1.1 Standards

For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

1.1.2 Time specifications and measuring

If not otherwise declared, all specifications/results of pickup/tripping/reset times refer to the output of signals via fast output relays (Type F).

BO = Binary output

Binary outputs:
Number and data acc. to the order variant, see also general diagrams of devices

1.1.3 Relay operating times

Switching time (OOT)	OOT (Output Operating Time): additional delay of the output medium used
Type S = standard relay	OOT: Closing time: average: 6 ms; maximum: < 10 ms; Opening time: average: 2 ms; maximum: < 6 ms;
Type F = fast relay	OOT: Closing time: average: 4 ms Opening time: average: 2 ms Maximum: : 5 ms
Type HS = High-Speed Relay	OOT: Closing time: average: 1 ms; Opening time: average: 6 ms; maximum: : 9 ms;

Summary

1.2 47/50 Overvoltage Protection

1.2.1 Specifications

- VDE 6435
- IEC/EN 60255-1, Item 7, Annex A, B
- IEC/EN 60255-127

1.2.2 3ph Voltage ph-to-grd, ph-to-ph V with definite time overvoltage stage

1.2.2.1 Pickup values

Test condition:	Fundamental components, RMS values $f_{ov} = 50 \text{ Hz}$, 60 Hz 0.300 V : threshold value : 340.000 V
Permissive tolerance/Limiting values:	In the range $f_{ov} \pm 10 \%$ $ S \leq 0.5 \%$ of setting value or 0.05 V
Test results/Remarks:	In the range $f_{ov} \pm 10 \%$ $ S \leq 0.5 \%$ of setting value or 0.05 V

1.2.2.2 Dropout ratio

Test condition:	See Item 1.2.2.1
Test values:	$r =$ stable dropout ratio $0.80 \leq r \leq 0.89$
Permissive tolerance/Limiting values:	$ S \leq 0.5 \%$ of dropout value or 0.05 V
Test results/Remarks:	$ S \leq 0.5 \%$ of dropout value or 0.05 V

1.2.2.3 Pickup times

Test condition:	See Item 1.2.2.1 1.2' threshold value
Permissive tolerance/Limiting values:	t approx. 25 ms + OOT at $f_{ov} = 50 \text{ Hz}$ 22 ms + OOT at $f_{ov} = 60 \text{ Hz}$
Test results/Remarks:	t approx. 25 ms + OOT at $f_{ov} = 50 \text{ Hz}$ 22 ms + OOT at $f_{ov} = 60 \text{ Hz}$

1.2.2.4 Dropout times

Test condition:	See Item 1.2.2.1
Permissive tolerance/Limiting values:	t approx. 20 ms + OOT
Test results/Remarks:	t approx. 20 ms + OOT

1.2.2.5 Time delays

Test condition:	See Item 1.2.2.1
Test values:	$0.00 \leq T \leq 60.00 \text{ s}$
Permissive tolerance/Limiting values:	$ S \leq 1 \%$ of setting value or 10 ms
Test results/Remarks:	$ S \leq 1 \%$ of setting value or 10 ms

1.2.3 3ph Voltage ph-to-grd, ph-to-ph V with inverse time overvoltage stage

1.2.3.1 Pickup values

Test condition:	Fundamental components, RMS values $f_{ov} = 50 \text{ Hz}$, 60 Hz 0.300 V : pickup value : 340.000 V
Permissive tolerance/Limiting values:	In the range $f_{ov} \pm 10 \%$ $ S \leq 0.5 \%$ of setting value or 0.05 V
Test results/Remarks:	In the range $f_{ov} \pm 10 \%$ $ S \leq 0.5 \%$ of setting value or 0.05 V

1.2.3.2 Dropout ratio

Test condition:	See Item 1.2.3.1
-----------------	------------------

Summary

Permissive tolerance/Limiting values:	$ S \leq 0.5 \%$ of setting value or 0.05 V
Test results/Remarks:	$ S \leq 0.5 \%$ of setting value or 0.05 V

1.2.3.3 Pickup times

Test condition:	See Item 1.2.3.1 1.2' pickup value
Permissive tolerance/Limiting values:	t approx. 25 ms + OOT at $f_{ov} = 50 \text{ Hz}$ 22 ms + OOT at $f_{ov} = 60 \text{ Hz}$
Test results/Remarks:	t approx. 25 ms + OOT at $f_{ov} = 50 \text{ Hz}$ 22 ms + OOT at $f_{ov} = 60 \text{ Hz}$

1.2.3.4 Dropout times

Test condition:	See Item 1.2.3.1 Reset time is sat 0 s
Permissive tolerance/Limiting values:	t approx. 20 ms + OOT
Test results/Remarks:	t approx. 20 ms + OOT

1.2.3.5 Definite time delays

Test condition:	See Item 1.2.3.1
Test values:	$0.00 \text{ s} \leq T \leq 60.00 \text{ s}$
Permissive tolerance/Limiting values:	$ S \leq 1 \%$ of setting value or 10 ms
Test results/Remarks:	$ S \leq 1 \%$ of setting value or 10 ms

1.2.3.6 Reset time

Test condition:	See Item 1.2.3.1
Test values:	$0.00 \text{ s} \leq T \leq 60.00 \text{ s}$
Permissive tolerance/Limiting values:	$ S \leq 1 \%$ of setting value or 10 ms
Test results/Remarks:	$ S \leq 1 \%$ of setting value or 10 ms

1.2.3.7 Inverse time characteristic

Test condition:	See Item 1.2.3.1 Charact.constant k: 0.00 $\leq k \leq 300.00$ Charact.constant α : 0.010 $\leq \alpha \leq 5.000$ Charact.constant β : 0.000 $\leq \beta \leq 5.000$ Time-dial: 0.05 $\leq T \leq 15.00$
Permissive tolerance/Limiting values:	$ S \leq 5 \%$ of the setting value or 30 ms
Test results/Remarks:	$ S \leq 5 \%$ of the setting value or 30 ms

1.2.4 Positive sequence V1

1.2.4.1 Pickup values

Test condition:	$f_{ov} = 50 \text{ Hz}$, 60 Hz 0.300 V : threshold value : 200.000 V
Permissive tolerance/Limiting values:	In the range $f_{ov} \pm 10 \%$ $ S \leq 0.5 \%$ of setting value or 0.05 V
Test results/Remarks:	In the range $f_{ov} \pm 10 \%$ $ S \leq 0.5 \%$ of setting value or 0.05 V

1.2.4.2 Dropout ratio

Test condition:	See Item 1.2.4.1
Test values:	$r =$ stable dropout ratio $0.80 \leq r \leq 0.89$
Permissive tolerance/Limiting values:	$ S \leq 0.5 \%$ of dropout value or 0.05 V
Test results/Remarks:	$ S \leq 0.5 \%$ of dropout value or 0.05 V

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Summary

1.2.4.3 Pickup times

Test condition:	See Item 1.2.4.1 1.2' threshold value
Permissive tolerance/Limiting values:	t approx. 25 ms + OOT at $f_{ov} = 50 \text{ Hz}$ 22 ms + OOT at $f_{ov} = 60 \text{ Hz}$
Test results/Remarks:	t approx. 25 ms + OOT at $f_{ov} = 50 \text{ Hz}$ 22 ms + OOT at $f_{ov} = 60 \text{ Hz}$

1.2.4.4 Dropout times

Test condition:	See Item 1.2.4.1
Permissive tolerance/Limiting values:	t approx. 20 ms + OOT
Test results/Remarks:	t approx. 20 ms + OOT

1.2.4.5 Time delays

Test condition:	See Item 1.2.4.1
Test values:	$0.00 \text{ s} \leq T \leq 60.00 \text{ s}$
Permissive tolerance/Limiting values:	$ S \leq 1 \%$ of setting value or 10 ms
Test results/Remarks:	$ S \leq 1 \%$ of setting value or 10 ms

1.2.5 Zero Sequence, Residual Voltage V0

1.2.5.1 Pickup values

Test condition:	RMS value, fundamental components, fundamental components over 2 cycles 0.300 V : threshold value : 340.000 V
Permissive tolerance/Limiting values:	In the range $f_{ov} \pm 10 \%$ $ S \leq 0.5 \%$ of setting value or 0.05 V
Test results/Remarks:	In the range $f_{ov} \pm 10 \%$ $ S \leq 0.5 \%$ of setting value or 0.05 V

1.2.5.2 Dropout ratio

Test condition:	See Item 1.2.5.1
Test values:	$r =$ stable dropout ratio $0.80 \leq r \leq 0.89$
Permissive tolerance/Limiting values:	$ S \leq 0.5 \%$ of dropout value or 0.05 V
Test results/Remarks:	$ S \leq 0.5 \%$ of dropout value or 0.05 V

1.2.5.3 Pickup times (Filter = RMS value, Standard Filter)

Test condition:	See Item 1.2.5.1 1.2' threshold value
Permissive tolerance/Limiting values:	t approx. 25 ms + OOT at $f_{ov} = 50 \text{ Hz}$ 22 ms + OOT at $f_{ov} = 60 \text{ Hz}$
Test results/Remarks:	t approx. 25 ms + OOT at $f_{ov} = 50 \text{ Hz}$ 22 ms + OOT at $f_{ov} = 60 \text{ Hz}$

1.2.5.4 Dropout times (Filter = RMS value, Standard Filter)

Test condition:	See Item 1.2.5.1
Permissive tolerance/Limiting values:	t approx. 20 ms + OOT at $f_{ov} = 50 \text{ Hz}$ 16.6 ms + OOT at $f_{ov} = 60 \text{ Hz}$
Test results/Remarks:	t approx. 20 ms + OOT at $f_{ov} = 50 \text{ Hz}$ 16.6 ms + OOT at $f_{ov} = 60 \text{ Hz}$

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Summary

1.2.6.5 Pickup times (Filter = over 2 cycles)

Test condition: See item 1.2.5.1
1.2" threshold value

Permissible tolerance/Limiting values: I approx.
45 ms + OOT at $f_{ovd} = 50$ Hz
39 ms + OOT at $f_{ovd} = 60$ Hz

Test results/Remarks: I approx.
45 ms + OOT at $f_{ovd} = 50$ Hz
39 ms + OOT at $f_{ovd} = 60$ Hz

1.2.6.8 Dropout times (Filter = over 2 cycles)

Test condition: See item 1.2.5.1

Permissible tolerance/Limiting values: I approx.
31.00 ms + OOT at $f_{ovd} = 50$ Hz
27.00 ms + OOT at $f_{ovd} = 60$ Hz

Test results/Remarks: I approx.
31.00 ms + OOT at $f_{ovd} = 50$ Hz
27.00 ms + OOT at $f_{ovd} = 60$ Hz

1.2.6.7 Time delays

Test condition: See item 1.2.5.1

Test values: $0.00 \text{ s} \leq T \leq 60.00 \text{ s}$

Permissible tolerance/Limiting values: $|\beta| \leq 1\%$ of setting value or 10 ms

Test results/Remarks: $|\beta| \leq 1\%$ of setting value or 10 ms

1.2.6 Any Voltage Vx

1.2.6.1 Pickup values

Test condition: Fundamental components, RMS values
 $f_{ovd} = 60$ Hz, 60 Hz
 $0.300 \text{ V} \leq \text{threshold value} \leq 340.000 \text{ V}$

Permissible tolerance/Limiting values: In the range $f_{ovd} \pm 10\%$
 $|\beta| \leq 0.5\%$ of setting value or 0.05 V

Test results/Remarks: In the range $f_{ovd} \pm 10\%$
 $|\beta| \leq 0.5\%$ of setting value or 0.05 V

1.2.6.2 Dropout ratio

Test condition: See item 1.2.6.1

Test values: $r = \text{stable dropout ratio}$
 $0.80 \leq r \leq 0.90$

Permissible tolerance/Limiting values: $|\beta| \leq 0.5\%$ of setting value or 0.05 V

Test results/Remarks: $|\beta| \leq 0.5\%$ of setting value or 0.05 V

1.2.6.3 Pickup times

Test condition: See item 1.2.6.1
1.2" threshold value

Permissible tolerance/Limiting values: I approx.
25 ms + OOT at $f_{ovd} = 60$ Hz
22 ms + OOT at $f_{ovd} = 80$ Hz

Test results/Remarks: I approx.
25 ms + OOT at $f_{ovd} = 50$ Hz
22 ms + OOT at $f_{ovd} = 60$ Hz

1.2.6.4 Dropout times

Test condition: See item 1.2.6.1

Permissible tolerance/Limiting values: I approx.
20 ms + OOT

Test results/Remarks: I approx.
20 ms + OOT

Summary

1.2.6.5 Time delays

Test condition: See item 1.2.6.1

Test values: $0.00 \text{ s} \leq T \leq 60.00 \text{ s}$

Permissible tolerance/Limiting values: $|\beta| \leq 1\%$ of setting value or 10 ms

Test results/Remarks: $|\beta| \leq 1\%$ of setting value or 10 ms

1.2.7 Negative sequence V2

1.2.7.1 Pickup values

Test condition: $f_{ovd} = 60$ Hz, 60 Hz
 $0.300 \text{ V} \leq \text{threshold value} \leq 200.000 \text{ V}$

Permissible tolerance/Limiting values: In the range $f_{ovd} \pm 10\%$
 $|\beta| \leq 0.5\%$ of setting value or 0.05 V

Test results/Remarks: In the range $f_{ovd} \pm 10\%$
 $|\beta| \leq 0.5\%$ of setting value or 0.05 V

1.2.7.2 Dropout ratio

Test condition: See item 1.2.7.1

Test values: $r = \text{stable dropout ratio}$
 $0.80 \leq r \leq 0.89$

Permissible tolerance/Limiting values: $|\beta| \leq 0.5\%$ of dropout value or 0.05 V

Test results/Remarks: $|\beta| \leq 0.5\%$ of dropout value or 0.05 V

1.2.7.3 Pickup times

Test condition: See item 1.2.7.1
1.2" threshold value

Permissible tolerance/Limiting values: I approx.
Measuring window length 1 cycle: 55ms + OOT
Measuring window length 10 cycles: 210ms + OOT
(depends on the measuring window length) at $f_{ovd} = 60$ Hz

Test results/Remarks: Measuring window length 1 cycle: 48ms + OOT
Measuring window length 10 cycles: 190ms + OOT
(depends on the measuring window length) at $f_{ovd} = 60$ Hz

I approx.
Measuring window length 1 cycle: 55ms + OOT
Measuring window length 10 cycles: 210ms + OOT
(depends on the measuring window length) at $f_{ovd} = 50$ Hz

Measuring window length 1 cycle: 48ms + OOT
Measuring window length 10 cycles: 190ms + OOT
(depends on the measuring window length) at $f_{ovd} = 80$ Hz

1.2.7.4 Dropout times

Test condition: See item 1.2.7.1

Permissible tolerance/Limiting values: I approx.
Measuring window length 1 cycle: 20ms + OOT
Measuring window length 10 cycles: 70ms + OOT
(depends on the measuring window length)

Test results/Remarks: I approx.
Measuring window length 1 cycle: 20ms + OOT
Measuring window length 10 cycles: 70ms + OOT
(depends on the measuring window length)

1.2.7.5 Time delays

Test condition: See item 1.2.7.1

Summary

Test values: $0.00 \text{ s} \leq T \leq 60.00 \text{ s}$

Permissible tolerance/Limiting values: $|\beta| \leq 1\%$ of setting value or 10 ms

Test results/Remarks: $|\beta| \leq 1\%$ of setting value or 10 ms

1.2.8 Ratio of negative-sequence to positive-sequence, V2/V1

1.2.8.1 Pickup values

Test condition: $f_{ovd} = 60$ Hz, 60 Hz
 $0.5\% \leq \text{threshold value} \leq 100\%$

Permissible tolerance/Limiting values: In the range $f_{ovd} \pm 10\%$
 $|\beta| \leq 0.5\%$ of setting value or 0.05 V

Test results/Remarks: In the range $f_{ovd} \pm 10\%$
 $|\beta| \leq 0.5\%$ of setting value or 0.05 V

1.2.8.2 Dropout ratio

Test condition: See item 1.2.8.1

Test values: $r = \text{stable dropout ratio}$
 $0.80 \leq r \leq 0.90$

Permissible tolerance/Limiting values: $|\beta| \leq 0.5\%$ of setting value or 0.05 V

Test results/Remarks: $|\beta| \leq 0.5\%$ of setting value or 0.05 V

1.2.8.3 Pickup times

Test condition: See item 1.2.8.1
1.2" threshold value

Permissible tolerance/Limiting values: I approx.
Measuring window length 1 cycle: 55ms + OOT
Measuring window length 10 cycles: 210ms + OOT
(depends on the measuring window length) at $f_{ovd} = 50$ Hz

Measuring window length 1 cycle: 48ms + OOT
Measuring window length 10 cycles: 190ms + OOT
(depends on the measuring window length) at $f_{ovd} = 60$ Hz

Test results/Remarks: I approx.
Measuring window length 1 cycle: 55ms + OOT
Measuring window length 10 cycles: 210ms + OOT
(depends on the measuring window length) at $f_{ovd} = 50$ Hz

Measuring window length 1 cycle: 48ms + OOT
Measuring window length 10 cycles: 190ms + OOT
(depends on the measuring window length) at $f_{ovd} = 60$ Hz

1.2.8.4 Dropout times

Test condition: See item 1.2.8.1

Permissible tolerance/Limiting values: I approx.
Measuring window length 1 cycle: 22ms + OOT
Measuring window length 10 cycles: 55ms + OOT
(depends on the measuring window length) at $f_{ovd} = 50$ Hz

Measuring window length 1 cycle: 18ms + OOT
Measuring window length 10 cycles: 45ms + OOT
(depends on the measuring window length) at $f_{ovd} = 80$ Hz

Test results/Remarks: I approx.
Measuring window length 1 cycle: 22ms + OOT
Measuring window length 10 cycles: 55ms + OOT
(depends on the measuring window length) at $f_{ovd} = 50$ Hz

Summary

Measuring window length 1 cycle: 18ms + OOT
Measuring window length 10 cycles: 45ms + OOT
(depends on the measuring window length) at $f_{ovd} = 60$ Hz

1.2.8.5 Time delays

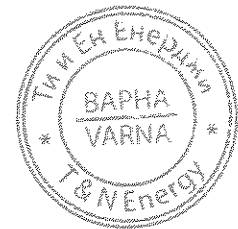
Test condition: See item 1.2.8.1

Test values: $0.00 \text{ s} \leq T \leq 60.00 \text{ s}$

Permissible tolerance/Limiting values: $|\beta| \leq 1\%$ of setting value or 10 ms

Test results/Remarks: $|\beta| \leq 1\%$ of setting value or 10 ms

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Summary

1.3 27 Undervoltage Protection	
1.3.1 Specifications	
-	VDE 0435
-	IECEN 60255-1, Item 7, Annex A, B
-	IECEN 60255-127
1.3.2 3ph Voltage ph-to-gnd, ph-to-ph define time with definite time undervoltage stages	
1.3.2.1 Pickup values	
Test condition:	fundamental components, RMS values 0.300 V < threshold value < 175.000 V
Permissive tolerance/Limiting values:	in the range $f_{pick} \pm 10\%$ $ k \leq 0.5\%$ of setting value or 0.05 V
Test results/Remarks:	in the range $f_{pick} \pm 10\%$ $ k \leq 0.5\%$ of setting value or 0.05 V
1.3.2.2 Dropout ratio	
Test condition:	see item 1.3.2.1
Test values:	$r =$ stable dropout ratio $1.01 \leq r \leq 1.20$
Permissive tolerance/Limiting values:	$ k \leq 0.5\%$ of dropout value or 0.05 V
Test results/Remarks:	$ k \leq 0.5\%$ of dropout value or 0.05 V
1.3.2.3 Pickup times	
Test condition:	see item 1.3.2.1 0.8" threshold value no pickup delay
Permissive tolerance/Limiting values:	1 approx. 25 ms + OOT at $f_{pick} = 50$ Hz 22 ms + OOT at $f_{pick} = 60$ Hz
Test results/Remarks:	1 approx. 25 ms + OOT at $f_{pick} = 50$ Hz 22 ms + OOT at $f_{pick} = 60$ Hz
1.3.2.4 Pickup delay	
Test condition:	see item 1.3.2.1 0.8" pickup value
Permissive tolerance/Limiting values:	1 approx. 40 ms
Test results/Remarks:	1 approx. 40 ms
1.3.2.5 Dropout times	
Test condition:	see item 1.3.2.1
Permissive tolerance/Limiting values:	1 approx. 20 ms + OOT
Test results/Remarks:	1 approx. 20 ms + OOT
1.3.2.6 Time delays	
Test condition:	see item 1.3.2.1
Test values:	$0.00 \text{ s} \leq T \leq 60.00 \text{ s}$
Permissive tolerance/Limiting values:	$ k \leq 1\%$ of setting value or 10 ms
Test results/Remarks:	$ k \leq 1\%$ of setting value or 10 ms
1.3.3 3ph Voltage ph-to-gnd, ph-to-ph with inverse time undervoltage stages	
1.3.3.1 Pickup values	
Test condition:	fundamental components, RMS values 0.300 V < threshold value < 175.000 V

Summary

Permissive tolerance/Limiting values:	in the range $f_{pick} \pm 10\%$ $ k \leq 0.5\%$ of setting value or 0.05 V
Test results/Remarks:	in the range $f_{pick} \pm 10\%$ $ k \leq 0.5\%$ of setting value or 0.05 V
1.3.3.2 Dropout ratio	
Test condition:	see item 1.3.3.1
Test values:	1.05
Permissive tolerance/Limiting values:	$ k \leq 0.5\%$ of dropout value or 0.05 V
Test results/Remarks:	$ k \leq 0.5\%$ of dropout value or 0.05 V
1.3.3.3 Pickup times	
Test condition:	see item 1.3.3.1 0.8" pickup value no pickup delay
Permissive tolerance/Limiting values:	1 approx. 25 ms + OOT at $f_{pick} = 50$ Hz 22 ms + OOT at $f_{pick} = 60$ Hz
Test results/Remarks:	1 approx. 25 ms + OOT at $f_{pick} = 50$ Hz 22 ms + OOT at $f_{pick} = 60$ Hz
1.3.3.4 Pickup delay	
Test condition:	see item 1.3.3.1 0.8" pickup value
Permissive tolerance/Limiting values:	1 approx. 40 ms
Test results/Remarks:	1 approx. 40 ms
1.3.3.5 Dropout times	
Test condition:	see item 1.3.3.1 with no read time
Permissive tolerance/Limiting values:	1 approx. 20 ms + OOT
Test results/Remarks:	1 approx. 20 ms + OOT
1.3.3.6 Inverse time characteristics	
Test condition:	see item 1.3.3.1 0.8" pickup value
Test values:	Charact.constant k: 0.00 < k < 300.00 Charact.constant c: 0.010 < c < 5.000 Charact.constant e: 0.000 < e < 5.000 Time dial: 0.05 < T < 15.00
Permissive tolerance/Limiting values:	5% of setting value or 30 ms
Test results/Remarks:	5% of setting value or 30 ms
1.3.3.7 Definite Time delays	
Test condition:	see item 1.3.3.1
Test values:	$0.00 \text{ s} \leq T \leq 60.00 \text{ s}$
Permissive tolerance/Limiting values:	$ k \leq 1\%$ of setting value or 10 ms
Test results/Remarks:	$ k \leq 1\%$ of setting value or 10 ms
1.3.3.8 Reset Time	
Test condition:	see item 1.3.3.1
Test values:	$0.00 \text{ s} \leq T \leq 60.00 \text{ s}$
Permissive tolerance/Limiting values:	$ k \leq 1\%$ of setting value or 10 ms
Test results/Remarks:	$ k \leq 1\%$ of setting value or 10 ms

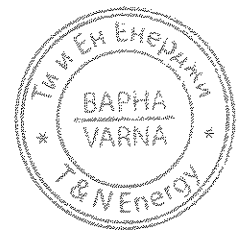
Summary

1.3.4 Positive-Sequence Voltage V1	
1.3.4.1 Pickup values	
Test condition:	fundamental components, RMS values 0.300 V < threshold value < 200.000 V
Permissive tolerance/Limiting values:	in the range $f_{pick} \pm 10\%$ $ k \leq 0.5\%$ of setting value or 0.05 V
Test results/Remarks:	in the range $f_{pick} \pm 10\%$ $ k \leq 0.5\%$ of setting value or 0.05 V
1.3.4.2 Dropout ratio	
Test condition:	see item 1.3.4.1
Test values:	$r =$ stable dropout ratio $1.01 \leq r \leq 1.20$
Permissive tolerance/Limiting values:	$ k \leq 0.5\%$ of dropout value or 0.05 V
Test results/Remarks:	$ k \leq 0.5\%$ of dropout value or 0.05 V
1.3.4.3 Pickup times	
Test condition:	see item 1.3.4.1 0.8" threshold value
Permissive tolerance/Limiting values:	1 approx. 25 ms + OOT at $f_{pick} = 50$ Hz 22 ms + OOT at $f_{pick} = 60$ Hz
Test results/Remarks:	1 approx. 25 ms + OOT at $f_{pick} = 50$ Hz 22 ms + OOT at $f_{pick} = 60$ Hz
1.3.4.4 Dropout times	
Test condition:	see item 1.3.4.1
Permissive tolerance/Limiting values:	1 approx. 20 ms + OOT
Test results/Remarks:	1 approx. 20 ms + OOT
1.3.4.5 Time delays	
Test condition:	see item 1.3.4.1
Test values:	$0.00 \text{ s} \leq T \leq 60.00 \text{ s}$
Permissive tolerance/Limiting values:	$ k \leq 1\%$ of setting value or 10 ms
Test results/Remarks:	$ k \leq 1\%$ of setting value or 10 ms
1.3.5 Any Voltage Vx	
1.3.5.1 Pickup values	
Test condition:	fundamental components, RMS values 0.300 V < threshold value < 200.000 V
Permissive tolerance/Limiting values:	in the range $f_{pick} \pm 10\%$ $ k \leq 0.5\%$ of setting value or 0.05 V
Test results/Remarks:	in the range $f_{pick} \pm 10\%$ $ k \leq 0.5\%$ of setting value or 0.05 V
1.3.5.2 Dropout ratio	
Test condition:	see item 1.3.5.1
Test values:	$r =$ stable dropout ratio $1.01 \leq r \leq 1.20$
Permissive tolerance/Limiting values:	$ k \leq 0.5\%$ of dropout value or 0.05 V
Test results/Remarks:	$ k \leq 0.5\%$ of dropout value or 0.05 V
1.3.5.3 Pickup times	
Test condition:	see item 1.3.5.1 0.8" threshold value

Summary

Permissive tolerance/Limiting values:	1 approx. 25 ms + OOT at $f_{pick} = 50$ Hz 22 ms + OOT at $f_{pick} = 60$ Hz
Test results/Remarks:	1 approx. 25 ms + OOT at $f_{pick} = 50$ Hz 22 ms + OOT at $f_{pick} = 60$ Hz
1.3.5.4 Dropout times	
Test condition:	see item 1.3.5.1
Permissive tolerance/Limiting values:	1 approx. 20 ms + OOT
Test results/Remarks:	1 approx. 20 ms + OOT
1.3.5.5 Time delays	
Test condition:	see item 1.3.5.1
Test values:	$0.00 \text{ s} \leq T \leq 60.00 \text{ s}$
Permissive tolerance/Limiting values:	$ k \leq 1\%$ of setting value or 10 ms
Test results/Remarks:	$ k \leq 1\%$ of setting value or 10 ms

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Summary

1.4	32 General Power Protection 3-phases
1.4.1	Specifications - VDE 0435 - IEC/EN 60255-1, Item 7, Annex A, B
1.4.2	Pickup values Test condition: -200.0 % to +200.0 % Test values: -200.0 % to +200.0 % Permissible tolerance/Limiting values: $ \delta \leq 0.5 \% S_N \pm 3 \% \text{ of setting value}$ Test results/Remarks: $ \delta \leq 0.5 \% S_N \pm 3 \% \text{ of setting value}$
1.4.3	Tripping characteristic Test condition: -89.0° to $+89.0^\circ$ Test values: -89.0° to $+89.0^\circ$ Permissible tolerance/Limiting values: function according to manual Test results/Remarks: function correct
1.4.4	Dropout ratio Test condition: 0.80 to 0.99 at +stage 1.01 to 1.10 at -stage Test values: 0.80 to 0.99 at +stage 1.01 to 1.10 at -stage Permissible tolerance/Limiting values: function according to manual Test results/Remarks: function correct
1.4.5	Pickup times Permissible tolerance/Limiting values: 1 approx. 55 ms + OOT at $f_{ovd} = 50$ Hz 45 ms + OOT at $f_{ovd} = 60$ Hz Test results/Remarks: 1 < 55 ms + OOT at $f_{ovd} = 50$ Hz < 45 ms + OOT at $f_{ovd} = 60$ Hz
1.4.6	Dropout times Permissible tolerance/Limiting values: 1 approx. 55 ms + OOT at $f_{ovd} = 50$ Hz 45 ms + OOT at $f_{ovd} = 60$ Hz Test results/Remarks: 1 < 55 ms + OOT at $f_{ovd} = 50$ Hz < 45 ms + OOT at $f_{ovd} = 60$ Hz
1.4.7	Time delays Test condition: added to the inherent operating times Test values: 0.00 s to 60.00 s Permissible tolerance/Limiting values: $ \delta \leq 1 \% \text{ of setting value or } 10 \text{ ms}$ Test results/Remarks: $ \delta \leq 1 \% \text{ or } 10 \text{ ms}$

Summary

1.5	48 Negative-Sequence Protection
1.5.1	Specifications - VDE 0435 - IEC/EN 60255-1, Item 7, Annex A, B - IEC/EN 60255-151
1.5.2	48 Negative-Sequence protection with definite time overcurrent stage
1.5.2.1	Pickup values 1.5.2.1.1 Reference value: rated current Test condition: $5.0 \% \leq I_p \leq 999.9 \%$ Test values: various settings Permissible tolerance/Limiting values: $ \delta \leq 2 \% \text{ of setting value or } 0.8 \% \text{ absolute}$ Test results/Remarks: $ \delta \leq 2 \% \text{ or } 0.8 \% \text{ absolute}$ 1.5.2.1.2 Reference value: pos. seq. current Test condition: $5.0 \% \leq I_p \leq 999.9 \%$ Test values: various settings Permissible tolerance/Limiting values: $ \delta \leq 2 \% \text{ of setting value or } 4 \% \text{ absolute}$ Test results/Remarks: $ \delta \leq 2 \% \text{ or } 4 \% \text{ absolute}$
1.5.2.2	Dropout ratio Test condition: see item 1.5.2.1 Test values: r = settable dropout ratio 0.80 \leq r \leq 0.99 Permissible tolerance/Limiting values: 0.60 \leq r \leq 0.99 Test results/Remarks: 0.60 \leq r \leq 0.99
1.5.2.3	Pickup times Test condition: see item 1.5.2.1 Test values: $I_{pickup} = 1.2$ 40 ms + OOT Permissible tolerance/Limiting values: 1 approx. 40 ms + OOT Test results/Remarks: 1 < 40 ms + OOT
1.5.2.4	Dropout times Test condition: see item 1.5.2.1 Test values: see item 1.5.2.3 Permissible tolerance/Limiting values: 1 approx. 35 ms + OOT Test results/Remarks: 1 < 35 ms + OOT
1.5.2.5	Time delays Test condition: added to the inherent operating times Test values: 0.00 s \leq T \leq 60.00 s Permissible tolerance/Limiting values: $ \delta \leq 1 \% \text{ of setting value or } 10 \text{ ms}$ Test results/Remarks: $ \delta \leq 1 \% \text{ or } 10 \text{ ms}$
1.5.3	48 Negative-Sequence protection with inverse time overcurrent stage
1.5.3.1	Pickup values 1.5.3.1.1 Reference value: rated current Test condition: $5.0 \% \leq I_p \leq 999.9 \%$ Test values: various settings Permissible tolerance/Limiting values: $ \delta \leq 2 \% \text{ of setting value or } 0.8 \% \text{ absolute}$ Test results/Remarks: $ \delta \leq 2 \% \text{ or } 0.8 \% \text{ absolute}$

Summary

1.5.3.1.2	Reference value: pos. seq. current Test condition: $5.0 \% \leq I_p \leq 999.9 \%$ Test values: various settings Permissible tolerance/Limiting values: $ \delta \leq 2 \% \text{ of setting value or } 0.8 \% \text{ absolute}$ Test results/Remarks: $ \delta \leq 2 \% \text{ or } 0.8 \% \text{ absolute}$
1.5.3.2	Pickup times Test condition: see item 1.5.3.1 Test values: $I_{pickup} = 1.2$ 40 ms + OOT Permissible tolerance/Limiting values: 1 approx. 40 ms + OOT Test results/Remarks: 1 < 40 ms + OOT
1.5.3.3	Dropout times Test condition: see item 1.5.3.1 Test values: see item 1.5.3.2 Permissible tolerance/Limiting values: 1 approx. 35 ms + OOT Test results/Remarks: 1 < 35 ms + OOT
1.5.3.4	Tripping time characteristic Test condition: see item 1.5.3.1 Test values: Time dial: 0.05 \leq T \leq 15.00 Permissible tolerance/Limiting values: 5 % of setting value or $\pm 2 \% \text{ of current tolerance or } 30 \text{ ms}$
1.5.3.4.1	IEC normal Inverse (type A) Test results/Remarks: 5 % of setting value or $\pm 2 \% \text{ of current tolerance or } 30 \text{ ms}$
1.5.3.4.2	IEC very Inverse (type B) Test results/Remarks: 5 % of setting value or $\pm 2 \% \text{ of current tolerance or } 30 \text{ ms}$
1.5.3.4.3	IEC extremely Inverse (type C) Test results/Remarks: 5 % of setting value or $\pm 2 \% \text{ of current tolerance or } 30 \text{ ms}$
1.5.3.4.4	IEC long-time Inverse (type B) Test results/Remarks: 5 % of setting value or $\pm 2 \% \text{ of current tolerance or } 30 \text{ ms}$
1.5.3.4.5	ANSI long-time Inverse Test results/Remarks: 5 % of setting value or $\pm 2 \% \text{ of current tolerance or } 30 \text{ ms}$
1.5.3.4.6	ANSI short-time Inverse Test results/Remarks: 5 % of setting value or $\pm 2 \% \text{ of current tolerance or } 30 \text{ ms}$
1.5.3.4.7	ANSI extremely Inverse Test results/Remarks: 5 % of setting value or $\pm 2 \% \text{ of current tolerance or } 30 \text{ ms}$
1.5.3.4.8	ANSI very Inverse Test results/Remarks: 5 % of setting value or $\pm 2 \% \text{ of current tolerance or } 30 \text{ ms}$
1.5.3.4.9	ANSI normal Inverse Test results/Remarks: 5 % of setting value or $\pm 2 \% \text{ of current tolerance or } 30 \text{ ms}$
1.5.3.4.10	ANSI moderately Inverse Test results/Remarks: 5 % of setting value or $\pm 2 \% \text{ of current tolerance or } 30 \text{ ms}$
1.5.3.4.11	ANSI definite Inverse Test results/Remarks: 5 % of setting value or $\pm 2 \% \text{ of current tolerance or } 30 \text{ ms}$
1.5.3.5	Dropout characteristics Test condition: see item 1.5.3.1 DIX emulation: < 0.8 times hold Test values: Time dial: 0.05 \leq T \leq 15.00 Permissible tolerance/Limiting values: 5 % of setting value or $\pm 2 \% \text{ of current tolerance or } 30 \text{ ms}$

Summary

1.5.3.5.1	IEC normal Inverse (type A) Test results/Remarks: 5 % of setting value or $\pm 2 \% \text{ of current tolerance or } 30 \text{ ms}$
1.5.3.5.2	IEC very Inverse (type B) Test results/Remarks: 5 % of setting value or $\pm 2 \% \text{ of current tolerance or } 30 \text{ ms}$
1.5.3.5.3	IEC extremely Inverse (type C) Test results/Remarks: 5 % of setting value or $\pm 2 \% \text{ of current tolerance or } 30 \text{ ms}$
1.5.3.5.4	IEC long-time Inverse (type B) Test results/Remarks: 5 % of setting value or $\pm 2 \% \text{ of current tolerance or } 30 \text{ ms}$
1.5.3.5.5	ANSI long-time Inverse Test results/Remarks: 5 % of setting value or $\pm 2 \% \text{ of current tolerance or } 30 \text{ ms}$
1.5.3.5.6	ANSI short-time Inverse Test results/Remarks: 5 % of setting value or $\pm 2 \% \text{ of current tolerance or } 30 \text{ ms}$
1.5.3.5.7	ANSI extremely Inverse Test results/Remarks: 5 % of setting value or $\pm 2 \% \text{ of current tolerance or } 30 \text{ ms}$
1.5.3.5.8	ANSI very Inverse Test results/Remarks: 5 % of setting value or $\pm 2 \% \text{ of current tolerance or } 30 \text{ ms}$
1.5.3.5.9	ANSI normal Inverse Test results/Remarks: 5 % of setting value or $\pm 2 \% \text{ of current tolerance or } 30 \text{ ms}$
1.5.3.5.10	ANSI moderately Inverse Test results/Remarks: 5 % of setting value or $\pm 2 \% \text{ of current tolerance or } 30 \text{ ms}$
1.5.3.5.11	ANSI definite Inverse Test results/Remarks: 5 % of setting value or $\pm 2 \% \text{ of current tolerance or } 30 \text{ ms}$

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Summary

Table with 2 columns: Section (e.g., 1.6 Thermal Overload Protection 3phases) and Description/Values. Includes sub-sections 1.6.1 Specifications, 1.6.2 Pickup threshold k * Ia, 1.6.3 Thermal warning stage, 1.6.4 Current warning stage, 1.6.5 Dropout ratio.

1 In case that the filter response exactly matches the user defined gain factor
2 In case that the user-defined gain factor is set below 3. The tolerance is amplified if the gain factor is larger
3 In case that the user-defined gain factor is set below 7. The tolerance is amplified if the gain factor is larger
4 In case that the user-defined gain factor is set below 7. The tolerance is amplified if the gain factor is larger

Summary

Table with 2 columns: Section (e.g., 1.7 50/51 Overcurrent Protection, Phases) and Description/Values. Includes sub-sections 1.7.1 Specifications, 1.7.2 Overcurrent Protection, phases with definite time overcurrent stages (definite time), 1.7.2.1 Pickup values, 1.7.2.2 Dropout ratio, 1.7.2.3 Pickup times.

1 In case that the filter response exactly matches the user defined gain factor
2 In case that the user-defined gain factor is set below 3. The tolerance is amplified if the gain factor is larger
3 In case that the user-defined gain factor is set below 7. The tolerance is amplified if the gain factor is larger

Summary

Table with 2 columns: Section (e.g., 1.6.8 Tripping time characteristics) and Description/Values. Includes sub-sections 1.6.8.1 Parameter k, tau, 1.6.8.2 Range of k, tau, 1.6.8.3 With and without prefeed, 1.6.8.4 Range I(Nk)Ia >= 8.



Summary

Table with 2 columns: Section (e.g., 1.7.2.4 Dropout times) and Description/Values. Includes sub-sections 1.7.2.4 Dropout times, 1.7.2.5 Time delay, 1.7.3 Overcurrent Protection, phases with inverse time overcurrent stage (inverse time), 1.7.3.1 Pickup values, 1.7.3.2 Dropout ratio.

1 In case that the filter response exactly matches the user defined gain factor
2 In case that the user-defined gain factor is set below 3. The tolerance is amplified if the gain factor is larger
3 In case that the user-defined gain factor is set below 7. The tolerance is amplified if the gain factor is larger

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Summary

Permissive tolerance/Limiting values:	1 % of dropout value
Test results/Remarks:	1% of dropout value
1.7.3.3 Pickup times	
Test condition:	see item 1.7.3.1 1.2 ¹ threshold
Permissive tolerance/Limiting values:	1 approx. 25 ms + OOT at 50 Hz 22 ms + OOT at 60 Hz
Test results/Remarks:	1 approx. 25 ms + OOT at 50 Hz 22 ms + OOT at 60 Hz
1.7.3.4 Dropout times	
Test condition:	see item 1.7.3.1
Permissive tolerance/Limiting values:	1 approx. 20 ms + OOT
Test results/Remarks:	1 approx. 20 ms + OOT
1.7.3.5 Tripping time characteristics	
Test condition:	see item 1.7.3.1 1.2 ¹ threshold
Test values:	Time dial: 0.05 ≤ T ≤ 15.00
Permissive tolerance/Limiting values:	0 % of the reference (calculated) value + 2 % of current tolerance or 30 ms
1.7.3.5.1 IEC normal Inverse (type A)	
Test results/Remarks:	5 % of the reference (calculated) value + 2 % of current tolerance or 30 ms
1.7.3.5.2 IEC very Inverse (type B)	
Test results/Remarks:	5 % of the reference (calculated) value + 2 % of current tolerance or 30 ms
1.7.3.5.3 IEC extremely Inverse (type C)	
Test results/Remarks:	5 % of the reference (calculated) value + 2 % of current tolerance or 30 ms
1.7.3.5.4 IEC long-time Inverse (type D)	
Test results/Remarks:	5 % of the reference (calculated) value + 2 % of current tolerance or 30 ms
1.7.3.5.5 ANSI long-time Inverse	
Test results/Remarks:	5 % of the reference (calculated) value + 2 % of current tolerance or 30 ms
1.7.3.5.6 ANSI short-time Inverse	
Test results/Remarks:	5 % of the reference (calculated) value + 2 % of current tolerance or 30 ms
1.7.3.5.7 ANSI extremely Inverse	
Test results/Remarks:	6 % of the reference (calculated) value + 2 % of current tolerance or 30 ms
1.7.3.5.8 ANSI very Inverse	
Test results/Remarks:	5 % of the reference (calculated) value + 2 % of current tolerance or 30 ms
1.7.3.5.9 ANSI normal Inverse	
Test results/Remarks:	5 % of the reference (calculated) value + 2 % of current tolerance or 30 ms
1.7.3.5.10 ANSI moderately Inverse	
Test results/Remarks:	5 % of the reference (calculated) value + 2 % of current tolerance or 30 ms
1.7.3.5.11 ANSI definite Inverse	
Test results/Remarks:	5 % of the reference (calculated) value + 2 % of current tolerance or 30 ms
1.7.3.6 Dropout characteristics	
Test condition:	see item 1.7.3.1 Disk emulation: 0.8 ¹ threshold
Test values:	Time dial: 0.05 ≤ T ≤ 15.00
Permissive tolerance/Limiting values:	0 % of the reference (calculated) value + 2 % of current tolerance or 30 ms
1.7.3.6.1 IEC normal Inverse (type A)	
Test results/Remarks:	6 % of the reference (calculated) value + 2 % of current tolerance or 30 ms

Summary

1.7.3.6.2 IEC very Inverse (type B)	
Test results/Remarks:	5 % of the reference (calculated) value + 2 % of current tolerance or 30 ms
1.7.3.6.3 IEC extremely Inverse (type C)	
Test results/Remarks:	5 % of the reference (calculated) value + 2 % of current tolerance or 30 ms
1.7.3.6.4 IEC long-time Inverse (type D)	
Test results/Remarks:	5 % of the reference (calculated) value + 2 % of current tolerance or 30 ms
1.7.3.6.5 ANSI long-time Inverse	
Test results/Remarks:	5 % of the reference (calculated) value + 2 % of current tolerance or 30 ms
1.7.3.6.6 ANSI short-time Inverse	
Test results/Remarks:	6 % of the reference (calculated) value + 2 % of current tolerance or 30 ms
1.7.3.6.7 ANSI extremely Inverse	
Test results/Remarks:	5 % of the reference (calculated) value + 2 % of current tolerance or 30 ms
1.7.3.6.8 ANSI very Inverse	
Test results/Remarks:	5 % of the reference (calculated) value + 2 % of current tolerance or 30 ms
1.7.3.6.9 ANSI normal Inverse	
Test results/Remarks:	5 % of the reference (calculated) value + 2 % of current tolerance or 30 ms
1.7.3.6.10 ANSI moderately Inverse	
Test results/Remarks:	5 % of the reference (calculated) value + 2 % of current tolerance or 30 ms
1.7.3.6.11 ANSI definite Inverse	
Test results/Remarks:	6 % of the reference (calculated) value + 2 % of current tolerance or 30 ms
1.7.4 Overcurrent Protection, phases with user-defined characteristics ¹	
1.7.4.1 Pickup	
Test condition:	0.030 I _{nom} ≤ threshold value ≤ 35.000 I _{nom} I _{nom} = 50 Hz, 60 Hz
Method of measurement = fundamental components of phases:	
Permissive tolerance/Limiting values:	1 % of setting value or 0.005 I _{nom}
Test results/Remarks:	1 % of setting value or 0.005 I _{nom}
Method of measurement = RMS value of phases, no filter applied:	
Permissive tolerance/Limiting values:	up to 30th harmonic: 1 % of setting value or 0.005 I _{nom} up to 50th harmonic, I _{50Hz} = 50 Hz: 3 % of setting value or 0.02 I _{nom} up to 50th harmonic, I _{60Hz} = 60 Hz: 4 % of setting value or 0.02 I _{nom}
Test results/Remarks:	up to 30th harmonic: 1 % of setting value or 0.005 I _{nom} up to 50th harmonic, I _{50Hz} = 50 Hz: 3 % of setting value or 0.02 I _{nom} up to 50th harmonic, I _{60Hz} = 60 Hz: 4 % of setting value or 0.02 I _{nom}
Method of measurement = RMS value of phases, with filter for the compensation of the amplitude attenuation due to the amplification:	
Permissive tolerance/Limiting values:	up to 30th harmonic: 1 % of setting value or 0.005 I _{nom} up to 50th harmonic, I _{50Hz} = 50 Hz: 2 % of setting value or 0.02 I _{nom} up to 60th harmonic, I _{60Hz} = 60 Hz: 3 % of setting value or 0.02 I _{nom}
Test results/Remarks:	up to 30th harmonic: 1 % of setting value or 0.005 I _{nom} up to 50th harmonic, I _{50Hz} = 50 Hz: 2 % of setting value or 0.02 I _{nom} up to 50th harmonic, I _{60Hz} = 60 Hz: 3 % of setting value or 0.02 I _{nom}
Method of measurement = RMS value of phases, with filter for the gain of harmonics (including compensation of the amplitude attenuation) ² :	
Permissive tolerance/Limiting values:	up to 30th harmonic: 1.5 % of setting value or 0.01 I _{nom} up to 50th harmonic, I _{50Hz} = 50 Hz: 3 % of setting value or 0.02 I _{nom} up to 60th harmonic, I _{60Hz} = 60 Hz: 4 % of setting value or 0.02 I _{nom}
Test results/Remarks:	up to 30th harmonic: 1.5 % of setting value or 0.01 I _{nom} up to 50th harmonic, I _{50Hz} = 50 Hz: 3 % of setting value or 0.02 I _{nom} up to 50th harmonic, I _{60Hz} = 60 Hz: 4 % of setting value or 0.02 I _{nom}

¹ Not available for Busbar Protection
² In case that the filter response exactly matches the user-defined gain factor
³ In case that the user-defined gain factor is set below 3, The tolerance is amplified if the gain factor is larger

Summary

1.7.4.2 Dropout ratio	
Test condition:	see item 1.7.4.1
Instantaneous:	
Test values:	1.05 ¹ threshold value 0.65 ¹ pickup value
Disk emulation:	
Test values:	0.90 ¹ threshold value
Permissive tolerance/Limiting values:	1 % of dropout value
Test results/Remarks:	1% of dropout value
1.7.4.3 Pickup times	
Test condition:	see item 1.7.4.1 1.2 ¹ threshold
Permissive tolerance/Limiting values:	1 approx. 25 ms + OOT at 50 Hz 22 ms + OOT at 60 Hz
Test results/Remarks:	1 approx. 25 ms + OOT at 50 Hz 22 ms + OOT at 60 Hz
1.7.4.4 Dropout times	
Test condition:	see item 1.7.4.1
Permissive tolerance/Limiting values:	1 approx. 25 ms + OOT
Test results/Remarks:	1 approx. 25 ms + OOT
1.7.4.5 Tripping time characteristics	
Test condition:	see item 1.7.4.1 1.2 ¹ threshold
Test values:	Time dial: 0.05 ≤ T ≤ 15.00
Permissive tolerance/Limiting values:	5 % of the reference (calculated) value + 2 % of current tolerance or 30 ms
Test results/Remarks:	5 % of the reference (calculated) value + 2 % of current tolerance or 30 ms
1.7.4.6 Dropout characteristics	
Test condition:	see item 1.7.4.1 Disk emulation: 0.8 ¹ threshold
Test values:	Time dial: 0.05 ≤ T ≤ 15.00
Permissive tolerance/Limiting values:	5 % of the reference (calculated) value + 2 % of current tolerance or 30 ms
Test results/Remarks:	5 % of the reference (calculated) value + 2 % of current tolerance or 30 ms

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Summary

1.8 07 Directional Overcurrent Protection, Phases	
1.8.1 Specifications	
- VDE 0435	
- IEC/EN 60255-1, Item 7, Annex A, B	
- IEC/EN 60255-151	
1.8.2 Directional overcurrent protection, phases with definite time overcurrent stages (definite time)	
1.8.2.1 Pickup values	
Test condition:	0.030 I _{nom} ≤ threshold value ≤ 35.000 I _{nom} I _{nom} = 50 Hz, 60 Hz
Method of measurement = fundamental components:	
Permissive tolerance/Limiting values:	1 % of setting value or 0.005 I _{nom}
Test results/Remarks:	1 % of setting value or 0.005 I _{nom}
Method of measurement = RMS value:	
Permissive tolerance/Limiting values:	up to 30 ¹ harmonics: 1 % of setting value or 0.005 I _{nom} up to 50th harmonic, I _{50Hz} = 50 Hz: 3 % of setting value or 0.02 I _{nom} up to 50th harmonic, I _{60Hz} = 60 Hz: 4 % of setting value or 0.02 I _{nom}
Test results/Remarks:	up to 30 ¹ harmonics: 1 % of setting value or 0.005 I _{nom} up to 50th harmonic, I _{50Hz} = 50 Hz: 3 % of setting value or 0.02 I _{nom} up to 50th harmonic, I _{60Hz} = 60 Hz: 4 % of setting value or 0.02 I _{nom}
1.8.2.2 Dropout ratio	
Test condition:	see item Error! Reference source not found.
Test values:	0.90 ≤ r ≤ 0.99
Permissive tolerance/Limiting values:	1 % of dropout value
Test results/Remarks:	1 % of dropout value
1.8.2.3 Pickup times	
Test condition:	see item Error! Reference source not found. 1.2 ¹ threshold
Permissive tolerance/Limiting values:	1 approx. 25 ms + OOT at 50 Hz 22 ms + OOT at 60 Hz
Test results/Remarks:	1 approx. 25 ms + OOT at 50 Hz 22 ms + OOT at 60 Hz
1.8.2.4 Dropout times	
Test condition:	see item Error! Reference source not found.
Permissive tolerance/Limiting values:	1 approx. 20 ms + OOT
Test results/Remarks:	1 approx. 20 ms + OOT
1.8.2.5 Time delay	
Test condition:	see item Error! Reference source not found. 1.2 ¹ threshold
Test values:	0.00 ≤ t ≤ 60.00 s
Permissive tolerance/Limiting values:	1 % of setting value or 10 ms
Test results/Remarks:	1 % of setting value or 10 ms

¹ In case that the user-defined gain factor is set below 7, The tolerance is amplified if the gain factor is larger

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Summary

1.8.3 Directional overcurrent protection, phases with inverse time overcurrent stage (inverse time)

1.8.3.1 Pickup values
Test condition: $0.030 I_{NLD} \leq$ threshold value $\leq 35.000 I_{NLD}$
 $f_{test} = 60$ Hz, 60 Hz
Method of measurement = fundamental components:
Permissive tolerance/limiting values: 1 % of setting value or 0.005 I_{NLD}
Test results/Remarks: 1 % of setting value or 0.005 I_{NLD}
Method of measurement = RMS value:
Permissive tolerance/limiting values: up to 30th harmonics: 1 % of setting value or 0.005 I_{NLD}
up to 60th harmonic, $f_{test} = 60$ Hz: 3 % of setting value or 0.02 I_{NLD}
up to 50th harmonic, $f_{test} = 60$ Hz: 4 % of setting value or 0.02 I_{NLD}
Test results/Remarks: up to 30th harmonics: 1 % of setting value or 0.005 I_{NLD}
up to 60th harmonic, $f_{test} = 60$ Hz: 3 % of setting value or 0.02 I_{NLD}
up to 50th harmonic, $f_{test} = 60$ Hz: 4 % of setting value or 0.02 I_{NLD}

1.8.3.2 Dropout ratio
Test condition: see item Error! Reference source not found.
Instantaneous:
Test values: 1.05 * threshold value
0.95 * pickup value
Disk emulation:
Test values: 0.90 * threshold value
Permissive tolerance/limiting values: 1 % of dropout value
Test results/Remarks: 1% of dropout value

1.8.3.3 Pickup times
Test condition: see item Error! Reference source not found.
1.2*threshold
Permissive tolerance/limiting values: 1 approx.
25 ms + OOT at 60 Hz
22 ms + OOT at 60 Hz
Test results/Remarks: 1 approx.
25 ms + OOT at 60 Hz
22 ms + OOT at 60 Hz

1.8.3.4 Dropout times
Test condition: see item Error! Reference source not found.
Permissive tolerance/limiting values: 1 approx.
20 ms + OOT
Test results/Remarks: 1 approx.
20 ms + OOT

1.8.3.5 Tripping time characteristics
Test condition: see item Error! Reference source not found.
1.2*threshold
Test values: Time delay: $0.05 \leq T \leq 15.00$
Permissive tolerance/limiting values: 5 % of setting value or ± 2 % of current tolerance or 10 ms

1.8.3.5.1 IEC normal Inverse (type A)
Test results/Remarks: 5 % of setting value or ± 2 % of current tolerance or 30 ms

1.8.3.5.2 IEC vary Inverse (type B)
Test results/Remarks: 5 % of setting value or ± 2 % of current tolerance or 30 ms

1.8.3.5.3 IEC extremely Inverse (type C)
Test results/Remarks: 5 % of setting value or ± 2 % of current tolerance or 30 ms

1.8.3.5.4 IEC long-time Inverse (type B)
Test results/Remarks: 5 % of setting value or ± 2 % of current tolerance or 30 ms

Summary

1.8.3.5.5 ANSI long-time Inverse
Test results/Remarks: 5 % of setting value or ± 2 % of current tolerance or 30 ms

1.8.3.5.6 ANSI short-time Inverse
Test results/Remarks: 5 % of setting value or ± 2 % of current tolerance or 30 ms

1.8.3.5.7 ANSI extremely Inverse
Test results/Remarks: 5 % of setting value or ± 2 % of current tolerance or 30 ms

1.8.3.5.8 ANSI vary Inverse
Test results/Remarks: 5 % of setting value or ± 2 % of current tolerance or 30 ms

1.8.3.5.9 ANSI normal Inverse
Test results/Remarks: 5 % of setting value or ± 2 % of current tolerance or 30 ms

1.8.3.5.10 ANSI moderately Inverse
Test results/Remarks: 5 % of setting value or ± 2 % of current tolerance or 30 ms

1.8.3.5.11 ANSI definite Inverse
Test results/Remarks: 5 % of setting value or ± 2 % of current tolerance or 30 ms

1.8.3.6 Dropout characteristics
Test condition: see item Error! Reference source not found.
Disk emulation: 0.8*threshold
Test values: Time delay: $0.05 \leq T \leq 15.00$
Permissive tolerance/limiting values: 5 % of setting value or ± 2 % of current tolerance or 10 ms

1.8.3.6.1 IEC normal Inverse (type A)
Test results/Remarks: 5 % of setting value or ± 2 % of current tolerance or 30 ms

1.8.3.6.2 IEC vary Inverse (type B)
Test results/Remarks: 5 % of setting value or ± 2 % of current tolerance or 30 ms

1.8.3.6.3 IEC extremely Inverse (type C)
Test results/Remarks: 5 % of setting value or ± 2 % of current tolerance or 30 ms

1.8.3.6.4 IEC long-time Inverse (type B)
Test results/Remarks: 5 % of setting value or ± 2 % of current tolerance or 30 ms

1.8.3.6.5 ANSI long-time Inverse
Test results/Remarks: 5 % of setting value or ± 2 % of current tolerance or 30 ms

1.8.3.6.6 ANSI short-time Inverse
Test results/Remarks: 5 % of setting value or ± 2 % of current tolerance or 30 ms

1.8.3.6.7 ANSI extremely Inverse
Test results/Remarks: 5 % of setting value or ± 2 % of current tolerance or 30 ms

1.8.3.6.8 ANSI vary Inverse
Test results/Remarks: 5 % of setting value or ± 2 % of current tolerance or 30 ms

1.8.3.6.9 ANSI normal Inverse
Test results/Remarks: 5 % of setting value or ± 2 % of current tolerance or 30 ms

1.8.3.6.10 ANSI moderately Inverse
Test results/Remarks: 5 % of setting value or ± 2 % of current tolerance or 30 ms

1.8.3.6.11 ANSI definite Inverse
Test results/Remarks: 5 % of setting value or ± 2 % of current tolerance or 30 ms

Summary

1.8.4 Overcurrent protection, phases with user-defined characteristic

1.8.4.1 Pickup
Test condition: $0.030 I_{NLD} \leq$ threshold value $\leq 35.000 I_{NLD}$
 $f_{test} = 60$ Hz, 60 Hz
Method of measurement = fundamental components:
Permissive tolerance/limiting values: 1 % of setting value or 0.005 I_{NLD}
Test results/Remarks: 1 % of setting value or 0.005 I_{NLD}
Method of measurement = RMS value:
Permissive tolerance/limiting values: up to 30th harmonics: 1 % of setting value or 0.005 I_{NLD}
up to 60th harmonic, $f_{test} = 60$ Hz: 3 % of setting value or 0.02 I_{NLD}
up to 50th harmonic, $f_{test} = 60$ Hz: 4 % of setting value or 0.02 I_{NLD}
Test results/Remarks: up to 30th harmonics: 1 % of setting value or 0.005 I_{NLD}
up to 60th harmonic, $f_{test} = 60$ Hz: 3 % of setting value or 0.02 I_{NLD}
up to 50th harmonic, $f_{test} = 60$ Hz: 4 % of setting value or 0.02 I_{NLD}

1.8.4.2 Dropout ratio
Test condition: see item Error! Reference source not found.
Instantaneous:
Test values: 1.05 * threshold value
0.95 * pickup value
Disk emulation:
Test values: 0.90 * threshold value
Permissive tolerance/limiting values: 1 % of dropout value
Test results/Remarks: 1% of dropout value

1.8.4.3 Pickup times
Test condition: see item Error! Reference source not found.
1.2*threshold
Permissive tolerance/limiting values: 1 approx.
25 ms + OOT at 60 Hz
22 ms + OOT at 60 Hz
Test results/Remarks: 1 approx.
25 ms + OOT at 60 Hz
22 ms + OOT at 60 Hz

1.8.4.4 Dropout times
Test condition: see item Error! Reference source not found.
Permissive tolerance/limiting values: 1 approx.
20 ms + OOT
Test results/Remarks: 1 approx.
20 ms + OOT

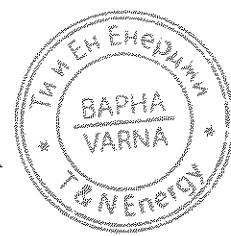
1.8.4.5 Tripping time characteristics
Test condition: see item Error! Reference source not found.
1.2*threshold
Test values: Time delay: $0.05 \leq T \leq 15.00$
Permissive tolerance/limiting values: 5 % of setting value or ± 2 % of current tolerance or 10 ms
Test results/Remarks: 5 % of setting value or ± 2 % of current tolerance or 10 ms

1.8.4.6 Dropout characteristics
Test condition: see item Error! Reference source not found.
Disk emulation: 0.8*threshold
Test values: Time delay: $0.05 \leq T \leq 15.00$
Permissive tolerance/limiting values: 5 % of setting value or ± 2 % of current tolerance or 10 ms
Test results/Remarks: 5 % of setting value or ± 2 % of current tolerance or 10 ms

Summary

1.8.6 Directional determination
Test condition: $0.030 I_{NLD} \leq$ threshold value $\leq 35.000 I_{NLD}$
 $f_{test} = 60$ Hz, 60 Hz
Test values: $-180^\circ \leq \varphi \leq 180^\circ$
Permissive tolerance/limiting values: 1'
Test results/Remarks: 4'

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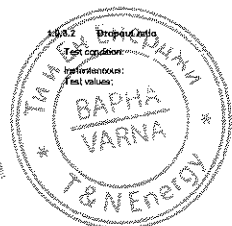


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Summary

Table with 2 columns: Test Item (e.g., 1.9.1 Specifications, 1.9.2.1 Pickup values) and Test results/Remarks. Includes test conditions and permissive tolerance/limiting values.

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Summary

Table with 2 columns: Test Item (e.g., 1.9.3.11 ANSI definite Inverse) and Test results/Remarks. Includes test conditions and permissive tolerance/limiting values.

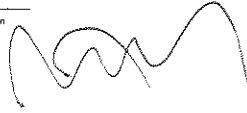
Summary

Table with 2 columns: Test Item (e.g., 1.9.2.4 Dropout times, 1.9.3 Overcurrent Protection) and Test results/Remarks. Includes test conditions and permissive tolerance/limiting values.

Summary

Table with 2 columns: Test Item (e.g., 1.9.3.11 ANSI definite Inverse) and Test results/Remarks. Includes test conditions and permissive tolerance/limiting values.

1 Not available for Busbar Protection



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Test results/Remarks: up to 50th harmonic, $f_{max} = 50$ Hz: 3 % of setting value or 0.001 I_{LVD}
up to 50th harmonic, $f_{max} = 60$ Hz: 4 % of setting value or 0.001 I_{LVD}
For protection CT:
up to 30th harmonic: 1 % of setting value or 0.005 I_{LVD}
up to 50th harmonic, $f_{max} = 50$ Hz: 3 % of setting value or 0.02 I_{LVD}
up to 50th harmonic, $f_{max} = 60$ Hz: 4 % of setting value or 0.02 I_{LVD}
For instrument CT:
up to 30th harmonic: 1 % of setting value or 0.0005 I_{LVD}
up to 50th harmonic, $f_{max} = 50$ Hz: 3 % of setting value or 0.001 I_{LVD}
up to 50th harmonic, $f_{max} = 60$ Hz: 4 % of setting value or 0.001 I_{LVD}

1.9.4.2 Dropout ratio

Test condition: see item 1.9.4.1
Instantaneous: see item 1.9.4.1
Test values: For protection CT:
95 % of pickup value or 0.016 I_{LVD} or 50% of pickup value (for secondary current threshold $\leq 0.001 I_{LVD}$)
For instrument CT:
95 % of pickup value or 0.0005 I_{LVD} or 50% of pickup value (for secondary current threshold $\leq 0.001 I_{LVD}$)
Disk emulation: 60% of pickup value
Test values: For protection CT:
1 % of setting value or 0.005 I_{LVD}
For instrument CT:
1 % of setting value or 0.0005 I_{LVD}
Test results/Remarks: For protection CT:
1 % of setting value or 0.005 I_{LVD}
For instrument CT:
1 % of setting value or 0.0005 I_{LVD}

1.9.4.3 Pickup times

Test condition: see item 1.9.4.1
1.2 * threshold
Permissible tolerance/Limiting values: approx.
25 ms + OOT at 50 Hz
22 ms + OOT at 60 Hz
Test results/Remarks: approx.
25 ms + OOT at 50 Hz
25 ms + OOT at 60 Hz

1.9.4.4 Dropout times

Test condition: see item 1.9.4.1
Permissible tolerance/Limiting values: approx.
25 ms + OOT
Test results/Remarks: approx.
25 ms + OOT

1.9.4.5 Tripping time characteristics

Test condition: see item 1.9.4.1
1.2 * threshold
Test values: Time dial: 0.05 $\leq T \leq 15.00$
Permissible tolerance/Limiting values: 5 % of the reference (calculated) value + 2 % of current tolerance or 30 ms
Test results/Remarks: 5 % of the reference (calculated) value + 2 % of current tolerance or 30 ms

Summary

1.9.4.6 Dropout characteristics

Test condition: see item 1.9.4.1
Disk emulation: 0.8 * threshold
Time dial: 0.05 $\leq T \leq 15.00$
Permissible tolerance/Limiting values: 5 % of the reference (calculated) value + 2 % of current tolerance or 30 ms
Test results/Remarks: 6 % of the reference (calculated) value + 2 % of current tolerance or 30 ms



Summary

1.10 67 Directional Overcurrent Protection, Ground

1.10.1 Specifications
- VDE 0435
- IEC/EN 60255-1, Item 7, Annex A, B
- IEC/EN 60255-151
1.10.2 Overcurrent Protection, 3I0 with definite time overcurrent stages (definite time)

1.10.2.1 Pickup values

Test condition: $0.030 I_{LVD} \leq 3I0 \leq 35.000 I_{LVD}$
Test values: $I_{pick} = 50$ Hz, 60 Hz
 $0.030 I_{LVD} \leq 3I0 \leq 20.000 I_{LVD}$
Method of measurement = fundamental components:
Permissible tolerance/Limiting values: $|k| \leq 1$ % of setting value or 0.005 I_{LVD}
 $|k| \leq 1$ % of setting value or 0.005 I_{LVD}
Test results/Remarks: $|k| \leq 1$ % of setting value or 0.005 I_{LVD}
Method of measurement = RMS value:
Permissible tolerance/Limiting values: up to 30th harmonics: $|k| \leq 1$ % of setting value or 0.005 I_{LVD}
up to 50th harmonic, $f_{max} = 50$ Hz: $|k| \leq 3$ % of setting value or 0.02 I_{LVD}
up to 50th harmonic, $f_{max} = 60$ Hz: $|k| \leq 4$ % of setting value or 0.02 I_{LVD}
up to 30th harmonics: $|k| \leq 1$ % of setting value or 0.005 I_{LVD}
up to 50th harmonic, $f_{max} = 50$ Hz: $|k| \leq 3$ % of setting value or 0.02 I_{LVD}
up to 50th harmonic, $f_{max} = 60$ Hz: $|k| \leq 4$ % of setting value or 0.02 I_{LVD}

1.10.2.2 Dropout ratio

Test condition: see item 1.10.2.1
Test values: r = settable dropout ratio
Permissible tolerance/Limiting values: $0.80 \leq r \leq 0.99$ for 12 0.5 Inetd
Test results/Remarks: $0.80 \leq r \leq 0.99$ for 12 0.5 Inetd

1.10.2.3 Pickup times

Test condition: see item 1.10.2.1
Test values: $3I0_{pick} = 2$
Permissible tolerance/Limiting values: approx.
30 ms + OOT at 50 Hz
25 ms + OOT at 60 Hz
Test results/Remarks: approx.
30 ms + OOT at 50 Hz
25 ms + OOT at 60 Hz

1.10.2.4 Dropout times

Test condition: see item 1.10.2.1
Test values: see item 1.10.2.3
Permissible tolerance/Limiting values: approx. 20 ms + OOT
Test results/Remarks: approx. 20 ms + OOT

1.10.2.5 Time delays

Test condition: added to the inherent operating time
Test values: $0.00 \text{ s} \leq T \leq 60.00 \text{ s}$
Permissible tolerance/Limiting values: $|k| \leq 1$ % of setting value or 10 ms
Test results/Remarks: $|k| \leq 1$ % of setting value or 10 ms

Summary

1.10.3 Overcurrent Protection, 3I0 with inverse time overcurrent stage (inverse time)

1.10.3.1 Pickup values

Test condition: $0.030 I_{LVD} \leq 3I0 \leq 35.000 I_{LVD}$
Time dial: $0.05 \leq T \leq 15.00$
Test values: $I_{pick} = 50$ Hz, 60 Hz
 $0.030 I_{LVD} \leq 3I0 \leq 20.000 I_{LVD}$
Method of measurement = fundamental components:
Permissible tolerance/Limiting values: $|k| \leq 1$ % of setting value or 0.005 I_{LVD}
Test results/Remarks: $|k| \leq 1$ % of setting value or 0.005 I_{LVD}
Method of measurement = RMS value:
Permissible tolerance/Limiting values: up to 30th harmonics: $|k| \leq 1$ % of setting value or 0.005 I_{LVD}
up to 50th harmonic, $f_{max} = 50$ Hz: $|k| \leq 3$ % of setting value or 0.02 I_{LVD}
up to 50th harmonic, $f_{max} = 60$ Hz: $|k| \leq 4$ % of setting value or 0.02 I_{LVD}
up to 30th harmonics: $|k| \leq 1$ % of setting value or 0.005 I_{LVD}
up to 50th harmonic, $f_{max} = 50$ Hz: $|k| \leq 3$ % of setting value or 0.02 I_{LVD}
up to 50th harmonic, $f_{max} = 60$ Hz: $|k| \leq 4$ % of setting value or 0.02 I_{LVD}

1.10.3.2 Dropout ratio

Test condition: see item 1.10.3.1
Instantaneous: see item 1.10.3.1
Test values: see item 1.10.3.1
Permissible tolerance/Limiting values: approx. 1.05 * threshold value
approx. 0.95 * pickup value
Test results/Remarks: approx. 1.05 * threshold value
approx. 0.95 * pickup value
Disk emulation: dropout time for 3I0I-threshold value ≤ 0.80
Test values: approx. 0.90 * threshold value
Test results/Remarks: approx. 0.90 * threshold value

1.10.3.3 Pickup times

Test condition: see item 1.10.3.1
Test values: pickup time for $2 \leq 3I0I$ -threshold value ≤ 20
Permissible tolerance/Limiting values: 5 % of set point value or +2 % current tolerance or 30 ms
Test results/Remarks: 5 % of set point value or +2 % current tolerance or 30 ms

1.10.3.4 Dropout times

Test condition: see item 1.10.3.1
Instantaneous: see item 1.10.3.1
Test values: see item 1.10.3.1
Permissible tolerance/Limiting values: approx. 20 ms + OOT
Test results/Remarks: approx. 20 ms + OOT
Disk emulation: dropout time for 3I0I-threshold value ≤ 0.80
Test values: 5 % of set point value or +2 % current tolerance or 30 ms
Permissible tolerance/Limiting values: 5 % of set point value or +2 % current tolerance or 30 ms

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Summary

Table with 2 columns: Test results/Remarks and values. Includes sections for tripping time characteristics (1.10.3.5-1.10.3.11), dropout characteristics (1.10.3.8), and pickup times (1.10.3.10-1.10.3.11).



Summary

Table with 2 columns: Test results/Remarks and values. Includes sections for ANSI normal/moderately/definite inverse (1.10.3.8.9-1.10.3.8.11), overcurrent protection (1.10.4), pickup (1.10.4.1), dropout ratio (1.10.4.2), and dropout times (1.10.4.4).

Summary

Table with 2 columns: Test results/Remarks and values. Includes sections for disk emulation (1.10.3.8), overcurrent protection (1.10.5), pickup values (1.10.6.1), dropout ratio (1.10.6.2), pickup times (1.10.6.3), dropout times (1.10.6.4), time delays (1.10.6.5), and directional determination (1.10.7).



Summary

Table with 2 columns: Test results/Remarks and values. Includes sections for overcurrent protection (1.10.6), pickup values (1.10.6.1), dropout ratio (1.10.6.2), pickup times (1.10.6.3), dropout times (1.10.6.4), time delays (1.10.6.5), and directional determination (1.10.7).



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Summary

1.10.7.2 Min. voltage V0 or V2	
Test condition:	0.16 V ± V0/V2 ± 20.00 V
Test values:	various settings
Permissible tolerance/Limiting values:	δ ≤ 1%
Test results/Remarks:	δ < 1%
1.10.7.3 Forward section +/-	
Test condition:	D' ≤ FN ± 90°
Test values:	various settings
Permissible tolerance/Limiting values:	δ ≤ 1°
Test results/Remarks:	δ < 1°
1.10.7.4 Polarization with	
Test condition:	- zero sequence - negative sequence
Test values:	various settings
Permissible tolerance/Limiting values:	function according to manual
Test results/Remarks:	function correct

Summary

1.11 50 High-Speed Instantaneous Overcurrent Protection	
1.11.1 Specifications	
- VDE 0435	
- IEC/EN 60255-1, Item 7, Annex A, B	
- IEC/EN 60255-151	
1.11.2 General test conditions	
f_{test}	50 Hz, 60 Hz
1.11.3 Pickup values	
Test condition:	0.030 $I_{pickup} \leq I_p \leq 35.000 I_{pickup}$
Test values:	0.100 $I_{pickup} \leq I_p \leq 5.000 I_{pickup}$
Permissible tolerance/Limiting values:	δ ≤ 5 % of setting value or 0.010 I_{pickup}
Test results/Remarks:	δ < 5 % of setting value or 0.010 I_{pickup}
1.11.4 Dropout ratio	
Test condition:	see item 1.11.2
Test values:	r = settable dropout ratio 0.50 ≤ r ≤ 0.80
Permissible tolerance/Limiting values:	δ ≤ 0 % of setting value
Test results/Remarks:	δ < 0 % of setting value
1.11.5 Pickup times	
Test condition:	current > 2x2 of threshold value
Test values:	t in ms
Permissible tolerance/Limiting values:	t ≤ 8 ms + COT
Test results/Remarks:	t < 8 ms + COT
1.11.6 Dropout times	
Test condition:	current change from > 2x2 to 0 of threshold value
Test values:	t in ms
Test results/Remarks:	t approx. 30 ms + COT

Summary

1.1 50BF Circuit Breaker Failure Protection	
1.1.1 General test conditions	
f_{test}	50 Hz, 60 Hz
I_{test}	1 A, 5 A
$I_{30\% error}$	Plausibility check / Direct release
$I_{2\% error}$	Plausibility check / Direct release
1.1.2 Pickup values	
Test condition:	0.030 $I_{pickup} \leq I_p \leq 35.000 I_{pickup}$
Permissible tolerance/Limiting values:	2 % of setting value or 1 % I_{pickup}
Test results/Remarks:	2 % of setting value or 1 % I_{pickup}
1.1.3 Dropout ratio	
Test condition:	approx. 0.05
Permissible tolerance/Limiting values:	2 % of setting value or 1 % I_{pickup}
Test results/Remarks:	2 % of setting value or 1 % I_{pickup}
1.1.4 Pickup times	
Test condition:	Pickup time
Permissible tolerance/Limiting values:	≤ 10 ms
Test results/Remarks:	< 10 ms
1.1.5 Dropout times	
1.1.5.1 Dropout time via the current-flow criterion	
Test condition:	dropout time via the current-flow criterion
Permissible tolerance/Limiting values:	≤ 15 ms typical
Test results/Remarks:	≤ 15 ms ¹
1.1.5.2 Dropout time, via circuit-breaker auxiliary contact criterion	
Test condition:	dropout time, via circuit-breaker auxiliary contact criterion
Permissible tolerance/Limiting values:	≤ 5 ms
Test results/Remarks:	≤ 5 ms ¹
1.1.6 Time delays	
Test condition:	added to the inherent operating times
Test values:	0.00 s to 60.00 s
Permissible tolerance/Limiting values:	≤ 1 % of setting value or 10 ms
Test results/Remarks:	≤ 1 % of setting value or 10 ms
1.1.7 Operation with CB auxiliary contact	
Permissible tolerance/Limiting values:	fund. acc. to manual
Test results/Remarks:	function correct

ВЯРНО С
ОРИГИНАЛА

Summary

1.2 51V Voltage-dependent Overcurrent-Protection	
1.2.1 Specifications	
- VDE 0435	
- IEC/EN 60255-1, Item 7, Annex A, B	
- IEC/EN 60255-127	
1.2.2 Voltage-released stage	
1.2.2.1 Pickup values >	
Test condition:	0.030 $I_{pickup} \leq \text{threshold value} \leq 35.000 I_{pickup}$
Test values:	$I_{pickup} = 50 \text{ Hz, } 60 \text{ Hz}$ 0.030 $I_{pickup} \leq \text{threshold value} \leq 16.000 I_{pickup}$
<u>Method of assessment = fundamental components of phases</u>	
Permissible tolerance/Limiting values:	1 % of setting value or 0.005 I_{pickup}
Test results/Remarks:	1 % of setting value or 0.005 I_{pickup}
<u>Method of assessment = RMS value of phases</u>	
Permissible tolerance/Limiting values:	up to 30th harmonic: 1 % of setting value or 0.005 I_{pickup} up to 50th harmonic, $I_{test} = 50 \text{ Hz}$: 3 % of setting value or 0.02 I_{pickup} up to 50th harmonic, $I_{test} = 60 \text{ Hz}$: 4 % of setting value or 0.02 I_{pickup}
Test results/Remarks:	up to 30 th harmonic: 1 % of setting value or 0.005 I_{pickup} up to 50th harmonic, $I_{test} = 60 \text{ Hz}$: 3 % of setting value or 0.02 I_{pickup} up to 50th harmonic, $I_{test} = 60 \text{ Hz}$: 4 % of setting value or 0.02 I_{pickup}
1.2.2.2 Dropout ratio	
Test condition:	see item 1.2.2.1
Instantaneous:	
Test values:	1.05 * threshold value 0.65 * pickup value
Dink emulation	
Test values:	0.80 * threshold value
Permissible tolerance/Limiting values:	1 % of dropout value
Test results/Remarks:	1 % of dropout value
1.2.2.3 Pickup values Vph-ph	
Test condition:	0.300 V ≤ threshold value ≤ 175.000V
Test values:	0.300 V ≤ threshold value ≤ 175.000V
Permissible tolerance/Limiting values:	in the range $f_{test} \pm 10 \%$ 0.5 % of setting value or 0.05 V
Test results/Remarks:	in the range $f_{test} \pm 10 \%$ 0.5 % of setting value or 0.05 V
1.2.2.4 Pickup time	
Test condition:	see item 1.2.2.1
Test values:	1.2 * threshold
Permissible tolerance/Limiting values:	t approx. 25 ms + COT at 60 Hz 22 ms + COT at 60 Hz
Test results/Remarks:	t approx. 25 ms + COT at 50 Hz 22 ms + COT at 60 Hz
1.2.2.5 Dropout times	
Test condition:	see item 1.2.2.1
Permissible tolerance/Limiting values:	t approx. 20 ms + COT
Test results/Remarks:	t approx. 20 ms + COT

¹ The dropout time is the time required by the CBFP function to detect that the CB is open. The time for switching a contact is not included