

**APPROVAL REPORT FOR THE PATTERN AND  
CONSTRUCTION OF ELECTRICITY METERS  
ANNEX II, MODULE B MEASURING INSTRUMENT DIRECTIVE**

MANUFACTURER : *Acrel Co., Ltd.*  
TYPE : *ADL400-D, ADL400-U*  
CLASS : *A or B or C(kWh)*  
DESCRIPTION : *Polyphase, Active Import/Export kWh, Indoor, Electricity Meter*

Tested in accordance with EN 50470-1: 2006, Electricity metering equipment (AC)  
Part 1: General requirements, tests and test conditions.  
Metering equipment (class indexes A, B and C)

and

EN 50470-3: 2006, Electricity metering equipment (AC)  
Part 3: Particular requirements - Static meters for active energy (class indexes A, B and C)

The meters tested satisfied the required specification.

ISSUED BY:



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Test Engineer

EVALUATED BY



K. Hunter  
Test Engineer  
Electricity Meter Approvals

REPORT ISSUE DATE: 14<sup>th</sup> March 2023

REPORT ISSUE NUMBER: 1

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*This report contains an evaluation of the results of testing performed at suitably accredited laboratories as detailed in the main body of the report.*



<b>Test Report Revision Record</b>		
<b>Issue Number</b>	<b>Issue Date</b>	<b>Comment / Reason for revision</b>
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## INTRODUCTION

The type tests described were carried out at the laboratories identified in the supporting documentation section of this report on behalf of:

CLIENT DETAILS:           Acrel Co., Ltd.  
                                  No. 253, Yulv Road,  
                                  Jiading,  
                                  Shanghai,  
                                  China

ORDER No:                   SH-202208069815

APPLICATION RECEIVED DATE: Aug. 29<sup>th</sup>, 2022

DATE OF RECEIPT OF SAMPLES: Oct. 08<sup>th</sup>, 2022

DATE OF TESTS: Oct. 28<sup>th</sup>, 2022 to Dec. 19<sup>th</sup>, 2022

Conditions under which the type tests took place:

Unless otherwise stated, the meters were examined at an ambient temperature of  $23^{\circ}\text{C} \pm 2^{\circ}\text{C}$ , and after the voltage circuits had been connected to reference voltage for at least 1 hour.

Unless otherwise stated, Polyphase tests were tested with a standard phase sequence of L1-L2-L3 (corresponding to the Brown, Black and Grey phases)

The tests were conducted using equipment, traceable to National and International Standards.



## INFORMATION ON THE ELECTRICITY METERS TESTED

Manufacturer : *Acrel Co., Ltd.*  
Type : *ADL400-D*  
Class : *A or B or C(kWh)*  
Temperature Range : *-40°C to +70°C*  
Type of circuit : *3 phase 4 wire, 3 phase 3 wire*  
I<sub>min</sub> : *0.1A*  
I<sub>tr</sub> : *1A*  
I<sub>ref</sub> : *10A*  
I<sub>max</sub> : *80A*  
Reference Supply Voltage : *3x230/400V*  
Rated Frequency : *50Hz*  
Pulse output constant : *400p/kWh*  
Manufacturers Serial No. : *M2, M5, M12, M13, 11809192840016, 11809192840045*

### Model Differences:

Model No.	Voltage range	Current range	Location of current terminal	Model Difference
<i>ADL400-D</i>	<i>3x230/400V</i>	<i>0.1-10(80)A</i>	<i>Up in and down out</i>	<i>The software and hardware inside the meter are completely the same, but the position of the current terminal is different.</i>
<i>ADL400-U</i>	<i>3x230/400V</i>	<i>0.1-10(80)A</i>	<i>Down in and up out</i>	

### Remark:

After comparison, select the model *ADL400-D* as the representative model to perform all tests specified in EN50470-1/3 covering other models.



## **SUPPORTING DOCUMENTATION**

Accredited Laboratory tests reports:

South China National Centre of Metrology (SCM)

The SCM laboratory is accredited by CNAS (Lab ID: L0730)

CNAS is recognised by the IAF as the accreditation body for China.

SGS-CSTC Standards Technical Service (Shanghai) Co., Ltd. Testing Center (SGS-Shanghai)

The SGS-Shanghai laboratory is accredited by CNAS (Lab ID: L0599)

CNAS is recognised by the IAF as the accreditation body for China.

## SUMMARY OF TEST RESULTS

Test Description	Requirements		Performed	Result
	General EN50470-1 Clause	Static EN50470-3 Clause		
<b>Tests of insulation properties</b>				
Impulse voltage	7.3.3		Yes	Complied
AC voltage	7.3.4	7.2	Yes	Complied
<b>Tests of accuracy requirements</b>				
Accuracy at reference conditions		8.7.2	Yes	Complied
Repeatability		8.7.4	Yes	Complied
Meter constant		8.7.10	Yes	Complied
Starting condition		8.7.9.2	Yes	Complied
No-load condition		8.7.9.3	Yes	Complied
Effect of influence quantities		8.7.5	Yes	Complied
<b>Tests of effect of disturbances of long duration</b>				
Severe voltage condition		8.7.7.2	Yes	Complied
Reverse phase sequence		8.7.7.3	Yes	Complied
Voltage unbalance		8.7.7.4	Yes	Complied
Short time overcurrents		8.7.8	Yes	Complied
Self-heating		8.7.7.5	Yes	Complied
Accuracy in the presence of harmonics		8.7.7.7	Yes	Complied
Odd harmonics and sub-harmonics		8.7.7.9	Yes	Complied
DC and even harmonics		8.7.7.8	Yes	Complied
Operation of auxiliary devices		8.7.7.13	N/A	N/A
<b>Tests of electrical requirements</b>				
Power consumption		7.1	Yes	Complied
Heating	7.2		Yes	Complied
<b>Tests for electromagnetic compatibility</b>				
Immunity to voltage dips and short interrupts	7.4.4		Yes	Complied
Radio interference suppression	7.4.13		Yes	Complied
Immunity to fast transients	7.4.7	8.7.7.14	Yes	Complied
Immunity to oscillatory waves	7.4.10	8.7.7.16	N/A	N/A
Immunity to radiated RF electromagnetic fields	7.4.6	8.7.7.12	Yes	Complied
Immunity to conducted RF disturbances	7.4.8	8.7.7.15	Yes	Complied
Immunity to electrostatic discharges	7.4.5		Yes	Complied
Immunity to surges	7.4.9		Yes	Complied
Immunity to AC magnetic fields	7.4.12	8.7.7.11	Yes	Complied
Immunity to continuous magnetic fields	7.4.11	8.7.7.10	Yes	Complied
<b>Tests of the effect of climatic environments</b>				
Dry heat test (Test B)	6.3.2		Yes	Complied
Cold test (Test A)	6.3.3		Yes	Complied
Damp heat cyclic test (Test Db)	6.3.4		Yes	Complied
Solar Radiation (Test Sa)	6.3.5		N/A	N/A
<b>Mechanical tests</b>				
Vibration test (Test Fc)	5.2.2.3		Yes	Complied
Shock test (Test Ea)	5.2.2.2		Yes	Complied
Spring hammer test (Test Eh)	5.2.2.1		Yes	Complied
Protection against penetration of dust and water	5.9		Yes	Complied
Resistance to heat and fire	5.8		Yes	Complied





## **SUMMARY OF TEST RESULTS (cont.)**

Tests performed at SCM

Report No: XNZ202202137

South China National Centre of Metrology (SCM)

The SCM laboratory is accredited by CNAS (Lab ID: L0730)

CNAS is recognised by the IAF as the accreditation body for China.

Tests performed at SGS-Shanghai

TDS No: TDS- SHES2208016104MI

SGS-CSTC Standards Technical Service (Shanghai) Co., Ltd. Testing Center (SGS-Shanghai)

The SGS-Shanghai laboratory is accredited by CNAS (Lab ID: L0599)

CNAS is recognised by the IAF as the accreditation body for China.

## EN50470-1 GENERAL REQUIREMENTS:

Clause	Requirements	Complied
4.1	Standard reference voltages	Yes
4.2	Standard current & current ranges	Yes
4.3	Standard reference frequency	Yes
5.1	The manufacturer shall specify the mechanical environment the meter is intended for.	Yes
	Meters shall be designed & constructed in such a way to avoid danger in normal use and conditions to avoid: <ul style="list-style-type: none"> <li>- electric shock</li> <li>- excessive temperature</li> <li>- fire</li> <li>- penetration of solid objects, dust and water</li> </ul>	Yes
5.2.1	Case can be sealed or closed in a way that protects internal parts and cannot be accessed without breaking a seal or the case	Yes
5.3	The window shall be transparent	Yes
5.4	Terminal requirements	Yes
	The terminal block material is capable of passing the tests given in EN ISO 75-2	Yes
5.5	The terminals shall have a separate cover which can be sealed independently of the meter cover	Yes
5.6	Clearance and creepage requirements	Yes
5.7	Insulating encased meter of protective class II requirements	Yes
5.10	Register readable under normal conditions and the principal unit is kWh	Yes
	Non-volatile memory has a minimum retention time of 4 months	Yes
	In the case of multiple values displayed by a single display, it shall be possible to display the contents of all relevant memories. Automatic sequencing displays shall display each value for at least 5 seconds	Yes
	The register shall be able to record and display, starting from zero, for a minimum of 4000hrs, the energy corresponding to maximum current at reference voltage and unity power factor	Yes
	The display of the total energy supplied shall not be able to reset during use	Yes
5.11	The meter has a test output capable of being monitored for test purposes	Yes
5.11.1	The maximum pulse frequency of the optical test output shall be $\leq 2.5\text{kHz}$ and the pulse transition time shall be $\leq 20\mu\text{s}$	Yes
5.11.2	The wavelength of the radiated signals for emitting systems is between 550nm and 1000nm	Yes
5.12.1	The meter bears the required information on the name plate	Yes
5.12.2	The meter has the connection diagram marked	Yes
5.13	An instruction manual for each meter type is made available	Yes



## RELIABILITY & DURABILITY

EN50470-3 X-Ref. 9.0 & 10.0

An assessment was made using the failure rates of components in accordance with the SIEMENS NORM SN 29500 Edition 2009-06.

These values were then applied to a spreadsheet (OfgemModelv4.3.xls) in accordance with our guidance notes (Model Guidelines v1.4.doc) and given an overall predicted life, in years.

As part of the type approval process, SGS carried out the assessment to verify that the submitted reliability model accurately reflects the physical sample supplied in order to ascertain an accurate predicted life.

Supporting documentation has been provided and found to be satisfactory where components that are not covered by the SN 29500 (LCD's, Batteries, and Contactors etc.) have been used and any subsequent arguments have been resolved.

The Electronic Metering Reliability Model predicts that this meter has a life of

**18.67 Years** with reference to Reliability Report EMA EMA313177/1/reliability dated 13<sup>th</sup> March 2023

Where this relates to a family of meters, the reliability model was performed on the most component populated meter variant, so as to simulate the worst case scenario, and all other meter variants will be at least similar.

## SOFTWARE REVIEW

EN50470-3 X-Ref. 11.0

A review was carried out in accordance with the WelmeC 7.2 2015 Software Guide (Measuring Instruments Directive 2014/32/EU)

The meter was stated to be Type P (Basic requirements for Embedded Software in a Built-for-purpose Measuring Instrument) and under Risk Class C. The meter was also considered for:-

Extension L - Specific software requirements for Long-term storage

Extension T - Specific software requirements for Data transmission

Extension I-3 - Specific software requirements (Active electrical energy meters)

The review was performed on software version **1766 V1.01**

Documentation provided by the manufacturer satisfied the requirement of the WelmeC software guide.



## 1 INSULATION

EN50470-1 X-Ref. 7.3

### 1.1 Impulse Voltage Test

X-Ref. 7.3.3

Sample No: M12

Test Procedure: EN50470-1 Impulse Voltage

#### Environmental Conditions

Temperature	22.6°C
Relative Humidity	52.9%
Barometric Pressure	998mB

Impulse specification: Test level 6kV @ 0.5J open circuit  
Time between impulse's 3s

The meter samples were placed on a flat conducting earth surface with the case wrapped in a conductive foil.

The test voltage was applied 10 times in each polarity between the points listed below:-

- 1) With one terminal of the voltage circuit connect to earth, the impulse voltage was applied between the common voltage/current meter terminal and earth.
- 2) With all meter terminals connected together, impulse voltage was applied between the meter terminals and earth.

During the tests auxiliary circuits with reference rated voltage  $\leq 40V$  were connected to earth.

On completion of the above test, the meter was found to function correctly and within the accuracy specification when subsequently operated under reference operating conditions, with no signs of damage or degradation in the meter's insulation properties.



## 1.2 AC Voltage Test

EN50470-1 X-Ref. 7.3.4

EN50470-3 X-Ref. 7.2

Sample No: M12

Test Procedure: EN50470-3 AC Voltage

### Environmental Conditions

Temperature	22.6°C
Relative Humidity	52.9%
Barometric Pressure	998mB

Test level 2kV & 4kV Test duration 1 minute.

The a.c. voltage tests were conducted as follows:

- 1) Between all meter voltage and current circuits connected together, and earth.
- 2) Between all circuits not intended to be connected together in service, and earth.

The earth consisting of a conductive foil wrapped around the meter and connected to a flat conducting earth surface, upon which the meter was placed.

During the tests auxiliary circuits with reference rated voltage  $\leq 40V$  were connected to earth.

On completion of the above test, the meter was found to function correctly and within the accuracy specification when subsequently operated under reference operating conditions, with no signs of damage or degradation in the meter's insulation properties.

## 2 ACCURACY AT REFERENCE CONDITIONS

EN50470-3 X-Ref. 8

### 2.1 Variation in Current

X-Ref. 8.7.2

Sample No: SHES2208016104MI -M12

Test Procedure: EN50470-3 Acc 3P4W kWh +P

Test Conditions:  $U_n: 3 \times 230/400V$   $F_n: 50Hz$   
 $I_{min}: 0.1A$   $I_{tr}: 1A$   $I_{ref}: 10A$   $I_{max}: 80A$

Test Circuit: *3 phase 4 wire*

Measurement Mode: *Active Import Energy kWh*

CURRENT	PF Cos. $\phi$	% Error	Limit of % Error		
			Accuracy		
			Class A	Class B	Class C
$I_{min}$	1.0	-0.40	$\pm 2.5$	$\pm 1.5$	$\pm 1.0$
$I_{tr}$	-	0.02	$\pm 2.0$	$\pm 1.0$	$\pm 0.5$
$10I_{tr}(I_{ref})$	-	0.03	$\pm 2.0$	$\pm 1.0$	$\pm 0.5$
$0.5I_{max}$	-	0.01	$\pm 2.0$	$\pm 1.0$	$\pm 0.5$
$I_{max}$	-	-0.08	$\pm 2.0$	$\pm 1.0$	$\pm 0.5$
$I_{tr}$	0.5ind	0.09	$\pm 2.0$	$\pm 1.0$	$\pm 0.5$
$10I_{tr}(I_{ref})$	-	0.02	$\pm 2.0$	$\pm 1.0$	$\pm 0.5$
$0.5I_{max}$	-	-0.14	$\pm 2.0$	$\pm 1.0$	$\pm 0.5$
$I_{max}$	-	0.18	$\pm 2.0$	$\pm 1.0$	$\pm 0.5$
$I_{tr}$	0.8cap	-0.04	$\pm 2.0$	$\pm 1.0$	$\pm 0.5$
$10I_{tr}(I_{ref})$	-	0.02	$\pm 2.0$	$\pm 1.0$	$\pm 0.5$
$0.5I_{max}$	-	0.04	$\pm 2.0$	$\pm 1.0$	$\pm 0.5$
$I_{max}$	-	-0.25	$\pm 2.0$	$\pm 1.0$	$\pm 0.5$

### Repeatability

EN50470-3 X-Ref 8.2

CURRENT	PF Cos. $\phi$	R1	R2	R3	Limit of % Error Variation		
		% Error Variance	% Error Variance	% Error Variance	Accuracy		
					Class A	Class B	Class C
$I_{min}$	1.0	0.00	0.00	0.00	$\pm 0.25$	$\pm 0.15$	$\pm 0.10$
$I_{tr}$	-	0.00	0.00	0.00	$\pm 0.20$	$\pm 0.10$	$\pm 0.05$
$10I_{tr}(I_{ref})$	-	0.00	0.00	0.00	$\pm 0.20$	$\pm 0.10$	$\pm 0.05$
$0.5I_{max}$	-	0.00	-0.01	-0.01	$\pm 0.20$	$\pm 0.10$	$\pm 0.05$
$I_{max}$	-	-0.01	0.00	-0.01	$\pm 0.20$	$\pm 0.10$	$\pm 0.05$
$I_{tr}$	0.5ind	0.00	0.00	0.00	$\pm 0.20$	$\pm 0.10$	$\pm 0.05$
$10I_{tr}(I_{ref})$	-	0.00	0.00	0.00	$\pm 0.20$	$\pm 0.10$	$\pm 0.05$
$0.5I_{max}$	-	0.01	0.02	0.03	$\pm 0.20$	$\pm 0.10$	$\pm 0.05$
$I_{max}$	-	-0.02	-0.02	0.00	$\pm 0.20$	$\pm 0.10$	$\pm 0.05$
$I_{tr}$	0.8cap	0.00	0.00	0.00	$\pm 0.20$	$\pm 0.10$	$\pm 0.05$
$10I_{tr}(I_{ref})$	-	0.00	0.00	0.00	$\pm 0.20$	$\pm 0.10$	$\pm 0.05$
$0.5I_{max}$	-	0.00	0.00	0.00	$\pm 0.20$	$\pm 0.10$	$\pm 0.05$
$I_{max}$	-	-0.01	0.01	-0.02	$\pm 0.20$	$\pm 0.10$	$\pm 0.05$



**Polyphase meter carrying a single-phase load, with balanced voltage applied to the voltage circuits.** X-Ref. 8.7.2

Test Conditions:  $U_n: 3 \times 230/400V$   $F_n: 50Hz$   
 $I_{min}: 0.1A$   $I_{tr}: 1A$   $I_{ref}: 10A$   $I_{max}: 80A$

Test Circuit: *3 phase 4 wire*

Measurement Mode: *Active Import Energy kWh*

Elements/Lines		I1 Element L1	I2 Element L2	I3 Element L3	Limit of % Error		
CURRENT	PF Cos. $\phi$	% Error	% Error	% Error	Accuracy		
					Class A	Class B	Class C
I <sub>tr</sub>	1.0	0.08	0.06	0.12	±3.0	±2.0	±1.0
10I <sub>tr</sub> (I <sub>ref</sub> /I <sub>n</sub> )	-	0.13	0.18	0.32	±3.0	±2.0	±1.0
0.5I <sub>max</sub>	-	0.25	0.23	0.31	±3.0	±2.0	±1.0
I <sub>max</sub>	-	0.16	0.17	0.25	±3.0	±2.0	±1.0
I <sub>tr</sub>	0.5ind	0.09	-0.07	-0.16	±3.0	±2.0	±1.0
10I <sub>tr</sub> (I <sub>ref</sub> /I <sub>n</sub> )	-	0.24	0.17	0.28	±3.0	±2.0	±1.0
0.5I <sub>max</sub>	-	0.32	0.16	0.30	±3.0	±2.0	±1.0
I <sub>max</sub>	-	0.20	0.09	0.22	±3.0	±2.0	±1.0

**Repeatability**

EN50470-3 X-Ref 8.2

R1 Element L1	R2 Element L1	R3 Element L1	R1 Element L2	R2 Element L2	R3 Element L2	R1 Element L3	R2 Element L3	R3 Element L3	Limit of % Error Variation		
% Error Var.	% Error Var.	% Error Var.	% Error Var.	% Error Var.	% Error Var.	% Error Var.	% Error Var.	% Error Var.	Accuracy		
									Class A	Class B	Class C
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	±0.30	±0.20	±0.10
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	±0.30	±0.20	±0.10
0.00	-0.01	-0.01	0.00	0.00	0.00	-0.01	-0.01	-0.01	±0.30	±0.20	±0.10
0.02	0.03	0.01	0.00	0.04	0.03	0.02	-0.01	-0.01	±0.30	±0.20	±0.10
0.00	0.00	0.00	0.00	-0.01	0.00	0.01	0.01	0.01	±0.30	±0.20	±0.10
0.00	0.00	0.00	0.00	0.01	0.01	0.00	0.00	0.00	±0.30	±0.20	±0.10
0.01	0.02	0.03	0.00	0.00	0.00	0.03	0.05	0.07	±0.30	±0.20	±0.10
-0.04	-0.05	-0.04	-0.01	-0.06	-0.07	-0.01	-0.02	-0.04	±0.30	±0.20	±0.10



**Variation in Current (cont.)**

X-Ref. 8.7.2

Sample No: M12	Test Procedure: EN50470-3 Acc 3P4W kWh -P
----------------	---

Test Conditions:  $Un: 3x230/400V$   $Fn: 50Hz$   
 $Imin: 0.1A$   $Itr: 1A$   $Iref: 10A$   $Imax: 80A$

Test Circuit: *3 phase 4 wire*

Measurement Mode: *Active Export Energy kWh*

CURRENT	PF Cos. $\phi$	% Error	Limit of % Error		
			Accuracy		
			Class A	Class B	Class C
Imin	1.0	0.47	$\pm 2.5$	$\pm 1.5$	$\pm 1.0$
Itr	-	0.32	$\pm 2.0$	$\pm 1.0$	$\pm 0.5$
10Itr(Iref)	-	0.12	$\pm 2.0$	$\pm 1.0$	$\pm 0.5$
0.5Imax	-	0.12	$\pm 2.0$	$\pm 1.0$	$\pm 0.5$
Imax	-	0.10	$\pm 2.0$	$\pm 1.0$	$\pm 0.5$
Itr	0.5ind	0.49	$\pm 2.0$	$\pm 1.0$	$\pm 0.5$
10Itr(Iref)	-	0.13	$\pm 2.0$	$\pm 1.0$	$\pm 0.5$
0.5Imax	-	0.13	$\pm 2.0$	$\pm 1.0$	$\pm 0.5$
Imax	-	0.20	$\pm 2.0$	$\pm 1.0$	$\pm 0.5$
Itr	0.8cap	0.35	$\pm 2.0$	$\pm 1.0$	$\pm 0.5$
10Itr(Iref)	-	0.14	$\pm 2.0$	$\pm 1.0$	$\pm 0.5$
0.5Imax	-	0.17	$\pm 2.0$	$\pm 1.0$	$\pm 0.5$
Imax	-	0.10	$\pm 2.0$	$\pm 1.0$	$\pm 0.5$

**Repeatability**

EN50470-3 X-Ref 8.2

CURRENT	PF Cos. $\phi$	R1	R2	R3	Limit of % Error Variation		
		% Error Variance	% Error Variance	% Error Variance	Accuracy		
					Class A	Class B	Class C
Imin	1.0	-0.02	-0.01	-0.01	$\pm 0.25$	$\pm 0.15$	$\pm 0.10$
Itr	-	0.00	0.00	0.00	$\pm 0.20$	$\pm 0.10$	$\pm 0.05$
10Itr(Iref)	-	0.00	0.00	0.00	$\pm 0.20$	$\pm 0.10$	$\pm 0.05$
0.5Imax	-	0.00	-0.01	-0.01	$\pm 0.20$	$\pm 0.10$	$\pm 0.05$
Imax	-	0.02	0.00	0.00	$\pm 0.20$	$\pm 0.10$	$\pm 0.05$
Itr	0.5ind	0.01	0.00	0.00	$\pm 0.20$	$\pm 0.10$	$\pm 0.05$
10Itr(Iref)	-	0.00	0.00	0.01	$\pm 0.20$	$\pm 0.10$	$\pm 0.05$
0.5Imax	-	0.02	0.03	0.04	$\pm 0.20$	$\pm 0.10$	$\pm 0.05$
Imax	-	-0.02	-0.03	-0.02	$\pm 0.20$	$\pm 0.10$	$\pm 0.05$
Itr	0.8cap	0.00	0.00	0.00	$\pm 0.20$	$\pm 0.10$	$\pm 0.05$
10Itr(Iref)	-	0.00	0.00	0.00	$\pm 0.20$	$\pm 0.10$	$\pm 0.05$
0.5Imax	-	0.00	0.00	0.00	$\pm 0.20$	$\pm 0.10$	$\pm 0.05$
Imax	-	0.02	0.02	0.01	$\pm 0.20$	$\pm 0.10$	$\pm 0.05$





**Polyphase meter carrying a single-phase load, with balanced voltage applied to the voltage circuits.** X-Ref. 8.7.2

Test Conditions:  $U_n: 3 \times 230/400V$   $F_n: 50Hz$   
 $I_{min}: 0.1A$   $I_{tr}: 1A$   $I_{ref}: 10A$   $I_{max}: 80A$

Test Circuit: *3 phase 4 wire*

Measurement Mode: *Active Export Energy kWh*

Elements/Lines		I1 Element L1	I2 Element L2	I3 Element L3	Limit of % Error		
CURRENT	PF Cos. $\phi$	% Error	% Error	% Error	Accuracy		
					Class A	Class B	Class C
$I_{tr}$	1.0	0.27	0.17	0.56	$\pm 3.0$	$\pm 2.0$	$\pm 1.0$
$10I_{tr}(I_{ref}/I_n)$	-	0.19	0.15	0.30	$\pm 3.0$	$\pm 2.0$	$\pm 1.0$
$0.5I_{max}$	-	0.23	0.27	0.33	$\pm 3.0$	$\pm 2.0$	$\pm 1.0$
$I_{max}$	-	0.22	0.26	0.31	$\pm 3.0$	$\pm 2.0$	$\pm 1.0$
$I_{tr}$	0.5ind	0.32	0.32	0.70	$\pm 3.0$	$\pm 2.0$	$\pm 1.0$
$10I_{tr}(I_{ref}/I_n)$	-	0.28	0.20	0.39	$\pm 3.0$	$\pm 2.0$	$\pm 1.0$
$0.5I_{max}$	-	0.36	0.21	0.38	$\pm 3.0$	$\pm 2.0$	$\pm 1.0$
$I_{max}$	-	0.37	0.24	0.37	$\pm 3.0$	$\pm 2.0$	$\pm 1.0$

**Repeatability**

EN50470-3 X-Ref 8.2

R1 Element L1	R2 Element L1	R3 Element L1	R1 Element L2	R2 Element L2	R3 Element L2	R1 Element L3	R2 Element L3	R3 Element L3	Limit of % Error Variation		
% Error Var.	% Error Var.	% Error Var.	% Error Var.	% Error Var.	% Error Var.	% Error Var.	% Error Var.	% Error Var.	Accuracy		
									Class A	Class B	Class C
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-0.01	$\pm 0.30$	$\pm 0.20$	$\pm 0.10$
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	$\pm 0.30$	$\pm 0.20$	$\pm 0.10$
0.00	-0.01	-0.01	0.00	0.00	0.00	0.00	-0.01	-0.01	$\pm 0.30$	$\pm 0.20$	$\pm 0.10$
0.00	0.03	-0.02	0.04	0.02	0.03	0.02	0.02	-0.03	$\pm 0.30$	$\pm 0.20$	$\pm 0.10$
0.01	-0.01	0.00	0.00	0.01	0.00	0.00	0.00	0.00	$\pm 0.30$	$\pm 0.20$	$\pm 0.10$
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	$\pm 0.30$	$\pm 0.20$	$\pm 0.10$
0.00	0.01	0.03	0.01	0.01	0.02	0.03	0.05	0.07	$\pm 0.30$	$\pm 0.20$	$\pm 0.10$
0.02	0.03	0.01	0.03	0.03	0.04	-0.02	-0.06	-0.06	$\pm 0.30$	$\pm 0.20$	$\pm 0.10$

**Variation in Current(cont.)**

X-Ref. 8.7.2

Sample No: SHES2207013595MI-M4	Test Procedure: EN50470-3 Acc 3P3W kWh +P
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Test Conditions:  $Un: 3x230/400V$   $Fn: 50Hz$   
 $Imin: 0.1A$   $Itr: 1A$   $Iref: 10A$   $Imax: 80A$

Test Circuit: *3 phase 3 wire*

Measurement Mode: *Active Import Energy kWh*

CURRENT	PF Cos. $\phi$	% Error	Limit of % Error		
			Accuracy		
			Class A	Class B	Class C
Imin	1.0	0.13	$\pm 2.5$	$\pm 1.5$	$\pm 1.0$
Itr	-	-0.01	$\pm 2.0$	$\pm 1.0$	$\pm 0.5$
10Itr(Iref)	-	-0.19	$\pm 2.0$	$\pm 1.0$	$\pm 0.5$
0.5Imax	-	-0.32	$\pm 2.0$	$\pm 1.0$	$\pm 0.5$
Imax	-	-0.39	$\pm 2.0$	$\pm 1.0$	$\pm 0.5$
Itr	0.5ind	0.16	$\pm 2.0$	$\pm 1.0$	$\pm 0.5$
10Itr(Iref)	-	0.10	$\pm 2.0$	$\pm 1.0$	$\pm 0.5$
0.5Imax	-	-0.10	$\pm 2.0$	$\pm 1.0$	$\pm 0.5$
Imax	-	-0.28	$\pm 2.0$	$\pm 1.0$	$\pm 0.5$
Itr	0.8cap	0.03	$\pm 2.0$	$\pm 1.0$	$\pm 0.5$
10Itr(Iref)	-	-0.15	$\pm 2.0$	$\pm 1.0$	$\pm 0.5$
0.5Imax	-	-0.33	$\pm 2.0$	$\pm 1.0$	$\pm 0.5$
Imax	-	-0.38	$\pm 2.0$	$\pm 1.0$	$\pm 0.5$

**Repeatability**

EN50470-3 X-Ref 8.2

CURRENT	PF Cos. $\phi$	R1	R2	R3	Limit of % Error Variation		
		% Error Variance	% Error Variance	% Error Variance	Accuracy		
					Class A	Class B	Class C
Imin	1.0	-0.01	0.00	-0.01	$\pm 0.25$	$\pm 0.15$	$\pm 0.10$
Itr	-	-0.01	-0.01	-0.01	$\pm 0.20$	$\pm 0.10$	$\pm 0.05$
10Itr(Iref)	-	0.01	0.01	0.02	$\pm 0.20$	$\pm 0.10$	$\pm 0.05$
0.5Imax	-	-0.01	0.01	0.04	$\pm 0.20$	$\pm 0.10$	$\pm 0.05$
Imax	-	-0.01	-0.02	-0.02	$\pm 0.20$	$\pm 0.10$	$\pm 0.05$
Itr	0.5ind	-0.02	-0.02	-0.03	$\pm 0.20$	$\pm 0.10$	$\pm 0.05$
10Itr(Iref)	-	0.00	0.01	-0.01	$\pm 0.20$	$\pm 0.10$	$\pm 0.05$
0.5Imax	-	0.01	0.01	0.02	$\pm 0.20$	$\pm 0.10$	$\pm 0.05$
Imax	-	-0.01	-0.01	-0.01	$\pm 0.20$	$\pm 0.10$	$\pm 0.05$
Itr	0.8cap	0.00	0.00	0.00	$\pm 0.20$	$\pm 0.10$	$\pm 0.05$
10Itr(Iref)	-	0.00	0.00	0.00	$\pm 0.20$	$\pm 0.10$	$\pm 0.05$
0.5Imax	-	0.01	0.00	0.01	$\pm 0.20$	$\pm 0.10$	$\pm 0.05$
Imax	-	0.00	-0.01	-0.03	$\pm 0.20$	$\pm 0.10$	$\pm 0.05$



**Polyphase meter carrying a single-phase load, with balanced voltage applied to the voltage circuits.**  
X-Ref. 8.7.2

Test Conditions:  $Un: 3x230/400V$   $Fn: 50Hz$   
 $I_{min}: 0.1A$   $I_{tr}: 1A$   $I_{ref}: 10A$   $I_{max}: 80A$

Test Circuit: *3 phase 3 wire*

Measurement Mode: *Active Import Energy kWh*

Elements/Lines		I1 Element L1	I2 Element L2	I3 Element L3	Limit of % Error		
CURRENT	PF Cos. $\phi$	% Error	% Error	% Error	Accuracy		
					Class A	Class B	Class C
I <sub>tr</sub>	1.0	-0.15	-	-0.00	±3.0	±2.0	±1.0
10I <sub>tr</sub> (I <sub>ref</sub> /I <sub>n</sub> )	-	-0.18	-	-0.07	±3.0	±2.0	±1.0
0.5I <sub>max</sub>	-	-0.21	-	-0.22	±3.0	±2.0	±1.0
I <sub>max</sub>	-	-0.21	-	-0.22	±3.0	±2.0	±1.0
I <sub>tr</sub>	0.5ind	-0.43	-	0.41	±3.0	±2.0	±1.0
10I <sub>tr</sub> (I <sub>ref</sub> /I <sub>n</sub> )	-	-0.45	-	0.02	±3.0	±2.0	±1.0
0.5I <sub>max</sub>	-	-0.50	-	-0.14	±3.0	±2.0	±1.0
I <sub>max</sub>	-	-0.60	-	-0.31	±3.0	±2.0	±1.0

**Repeatability**

EN50470-3 X-Ref 8.2

R1 Element L1	R2 Element L1	R3 Element L1	R1 Element L2	R2 Element L2	R3 Element L2	R1 Element L3	R2 Element L3	R3 Element L3	Limit of % Error Variation		
% Error Var.	% Error Var.	% Error Var.	% Error Var.	% Error Var.	% Error Var.	% Error Var.	% Error Var.	% Error Var.	Accuracy		
									Class A	Class B	Class C
0.00	0.00	0.01	-	-	-	-0.01	-0.02	-0.02	±0.30	±0.20	±0.10
0.00	0.00	0.01	-	-	-	0.01	0.01	0.01	±0.30	±0.20	±0.10
-0.01	0.00	-0.01	-	-	-	0.02	0.04	0.02	±0.30	±0.20	±0.10
0.00	-0.03	0.00	-	-	-	-0.02	-0.03	-0.05	±0.30	±0.20	±0.10
0.01	0.01	0.02	-	-	-	-0.01	-0.01	0.00	±0.30	±0.20	±0.10
-0.01	-0.01	-0.01	-	-	-	0.00	-0.01	-0.01	±0.30	±0.20	±0.10
0.01	0.01	0.00	-	-	-	0.00	0.01	0.01	±0.30	±0.20	±0.10
-0.01	-0.02	-0.04	-	-	-	-0.02	-0.03	-0.03	±0.30	±0.20	±0.10

**Variation in Current (cont.)**

X-Ref. 8.7.2

Sample No: SHES2207013595MI-M4	Test Procedure: EN50470-3 Acc 1P2W kWh -P 3P3W kWh -P 3P4W kWh -P
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Test Conditions:  $Un: 3x230/400V$   $Fn: 50Hz$   
 $Imin: 0.1A$   $Itr: 1A$   $Iref: 10A$   $Imax: 80A$

Test Circuit: *3 phase 3 wire*

Measurement Mode: *Active Export Energy kWh*

CURRENT	PF Cos. $\phi$	% Error	Limit of % Error		
			Accuracy		
			Class A	Class B	Class C
Imin	1.0	-0.41	$\pm 2.5$	$\pm 1.5$	$\pm 1.0$
Itr	-	-0.28	$\pm 2.0$	$\pm 1.0$	$\pm 0.5$
10Itr(Iref)	-	-0.18	$\pm 2.0$	$\pm 1.0$	$\pm 0.5$
0.5Imax	-	-0.22	$\pm 2.0$	$\pm 1.0$	$\pm 0.5$
Imax	-	-0.02	$\pm 2.0$	$\pm 1.0$	$\pm 0.5$
Itr	0.5ind	-0.31	$\pm 2.0$	$\pm 1.0$	$\pm 0.5$
10Itr(Iref)	-	0.05	$\pm 2.0$	$\pm 1.0$	$\pm 0.5$
0.5Imax	-	0.05	$\pm 2.0$	$\pm 1.0$	$\pm 0.5$
Imax	-	0.08	$\pm 2.0$	$\pm 1.0$	$\pm 0.5$
Itr	0.8cap	-0.30	$\pm 2.0$	$\pm 1.0$	$\pm 0.5$
10Itr(Iref)	-	-0.16	$\pm 2.0$	$\pm 1.0$	$\pm 0.5$
0.5Imax	-	-0.09	$\pm 2.0$	$\pm 1.0$	$\pm 0.5$
Imax	-	-0.11	$\pm 2.0$	$\pm 1.0$	$\pm 0.5$

**Repeatability**

EN50470-3 X-Ref 8.2

CURRENT	PF Cos. $\phi$	R1	R2	R3	Limit of % Error Variation		
		% Error Variance	% Error Variance	% Error Variance	Accuracy		
					Class A	Class B	Class C
Imin	1.0	0.01	0.01	0.01	$\pm 0.25$	$\pm 0.15$	$\pm 0.10$
Itr	-	-0.01	-0.01	-0.01	$\pm 0.20$	$\pm 0.10$	$\pm 0.05$
10Itr(Iref)	-	0.01	0.01	0.01	$\pm 0.20$	$\pm 0.10$	$\pm 0.05$
0.5Imax	-	0.02	0.04	0.03	$\pm 0.20$	$\pm 0.10$	$\pm 0.05$
Imax	-	0.00	-0.01	-0.01	$\pm 0.20$	$\pm 0.10$	$\pm 0.05$
Itr	0.5ind	-0.02	-0.02	-0.03	$\pm 0.20$	$\pm 0.10$	$\pm 0.05$
10Itr(Iref)	-	-0.02	-0.03	0.00	$\pm 0.20$	$\pm 0.10$	$\pm 0.05$
0.5Imax	-	0.00	-0.01	-0.01	$\pm 0.20$	$\pm 0.10$	$\pm 0.05$
Imax	-	0.00	0.01	0.02	$\pm 0.20$	$\pm 0.10$	$\pm 0.05$
Itr	0.8cap	-0.01	-0.01	0.00	$\pm 0.20$	$\pm 0.10$	$\pm 0.05$
10Itr(Iref)	-	0.00	0.01	0.01	$\pm 0.20$	$\pm 0.10$	$\pm 0.05$
0.5Imax	-	-0.01	0.01	0.00	$\pm 0.20$	$\pm 0.10$	$\pm 0.05$
Imax	-	0.00	-0.02	-0.04	$\pm 0.20$	$\pm 0.10$	$\pm 0.05$



**Polyphase meter carrying a single-phase load, with balanced voltage applied to the voltage circuits.** X-Ref. 8.7.2

Test Conditions:  $Un: 3x230/400V$   $Fn: 50Hz$   
 $I_{min}: 0.1A$   $I_{tr}: 1A$   $I_{ref}: 10A$   $I_{max}: 80A$

Test Circuit: *3 phase 3 wire*

Measurement Mode: *Active Export Energy kWh*

Elements/Lines		I1 Element L1	I2 Element L2	I3 Element L3	Limit of % Error		
CURRENT	PF Cos. $\phi$	% Error	% Error	% Error	Accuracy		
					Class A	Class B	Class C
Itr	1.0	-0.21	-	-0.46	$\pm 3.0$	$\pm 2.0$	$\pm 1.0$
10Itr(Iref/In)	-	-0.17	-	-0.11	$\pm 3.0$	$\pm 2.0$	$\pm 1.0$
0.5Imax	-	-0.12	-	-0.10	$\pm 3.0$	$\pm 2.0$	$\pm 1.0$
Imax	-	0.00	-	-0.03	$\pm 3.0$	$\pm 2.0$	$\pm 1.0$
Itr	0.5ind	-0.55	-	-0.49	$\pm 3.0$	$\pm 2.0$	$\pm 1.0$
10Itr(Iref/In)	-	-0.43	-	-0.02	$\pm 3.0$	$\pm 2.0$	$\pm 1.0$
0.5Imax	-	-0.30	-	0.08	$\pm 3.0$	$\pm 2.0$	$\pm 1.0$
Imax	-	-0.17	-	0.17	$\pm 3.0$	$\pm 2.0$	$\pm 1.0$

**Repeatability**

EN50470-3 X-Ref 8.2

R1 Element L1	R2 Element L1	R3 Element L1	R1 Element L2	R2 Element L2	R3 Element L2	R1 Element L3	R2 Element L3	R3 Element L3	Limit of % Error Variation		
% Error Var.	% Error Var.	% Error Var.	% Error Var.	% Error Var.	% Error Var.	% Error Var.	% Error Var.	% Error Var.	Accuracy		
									Class A	Class B	Class C
0.01	0.00	0.00	-	-	-	-0.01	-0.01	-0.01	$\pm 0.30$	$\pm 0.20$	$\pm 0.10$
0.01	0.01	0.01	-	-	-	0.01	0.01	0.01	$\pm 0.30$	$\pm 0.20$	$\pm 0.10$
0.00	0.02	0.02	-	-	-	0.02	0.02	0.01	$\pm 0.30$	$\pm 0.20$	$\pm 0.10$
-0.04	0.00	0.00	-	-	-	0.03	0.02	0.00	$\pm 0.30$	$\pm 0.20$	$\pm 0.10$
0.01	0.01	0.00	-	-	-	0.01	-0.01	0.00	$\pm 0.30$	$\pm 0.20$	$\pm 0.10$
0.01	0.01	0.00	-	-	-	-0.01	-0.01	-0.02	$\pm 0.30$	$\pm 0.20$	$\pm 0.10$
0.00	0.01	0.01	-	-	-	0.02	0.01	0.02	$\pm 0.30$	$\pm 0.20$	$\pm 0.10$
-0.02	-0.01	-0.04	-	-	-	0.00	-0.02	-0.03	$\pm 0.30$	$\pm 0.20$	$\pm 0.10$

**Variation in Current(cont.)**

X-Ref. 8.7.2

Sample No: SHES2207013595MI-M4	Test Procedure: EN50470-3 Acc 1P2W kWh +P
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Test Conditions:  $U_n: 230V$   $F_n: 50Hz$   
 $I_{min}: 0.1A$   $I_{tr}: 1A$   $I_{ref}: 10A$   $I_{max}: 80A$

Test Circuit: *1 phase 2 wire(only L1)*

Measurement Mode: *Active Import Energy kWh*

CURRENT	PF Cos. $\phi$	% Error	Limit of % Error		
			Accuracy		
			Class A	Class B	Class C
$I_{min}$	1.0	0.36	$\pm 2.5$	$\pm 1.5$	$\pm 1.0$
$I_{tr}$	-	0.17	$\pm 2.0$	$\pm 1.0$	$\pm 0.5$
10 $I_{tr}(I_{ref})$	-	-0.16	$\pm 2.0$	$\pm 1.0$	$\pm 0.5$
0.5 $I_{max}$	-	-0.38	$\pm 2.0$	$\pm 1.0$	$\pm 0.5$
$I_{max}$	-	-0.27	$\pm 2.0$	$\pm 1.0$	$\pm 0.5$
$I_{tr}$	0.5ind	0.24	$\pm 2.0$	$\pm 1.0$	$\pm 0.5$
10 $I_{tr}(I_{ref})$	-	-0.40	$\pm 2.0$	$\pm 1.0$	$\pm 0.5$
0.5 $I_{max}$	-	-0.43	$\pm 2.0$	$\pm 1.0$	$\pm 0.5$
$I_{max}$	-	-0.44	$\pm 2.0$	$\pm 1.0$	$\pm 0.5$
$I_{tr}$	0.8cap	0.38	$\pm 2.0$	$\pm 1.0$	$\pm 0.5$
10 $I_{tr}(I_{ref})$	-	-0.01	$\pm 2.0$	$\pm 1.0$	$\pm 0.5$
0.5 $I_{max}$	-	-0.17	$\pm 2.0$	$\pm 1.0$	$\pm 0.5$
$I_{max}$	-	-0.38	$\pm 2.0$	$\pm 1.0$	$\pm 0.5$

**Repeatability**

EN50470-3 X-Ref 8.2

CURRENT	PF Cos. $\phi$	R1	R2	R3	Limit of % Error Variation		
		% Error Variance	% Error Variance	% Error Variance	Accuracy		
					Class A	Class B	Class C
$I_{min}$	1.0	-0.01	0.01	-0.01	$\pm 0.25$	$\pm 0.15$	$\pm 0.10$
$I_{tr}$	-	0.01	0.00	0.00	$\pm 0.20$	$\pm 0.10$	$\pm 0.05$
10 $I_{tr}(I_{ref})$	-	0.01	0.02	0.02	$\pm 0.20$	$\pm 0.10$	$\pm 0.05$
0.5 $I_{max}$	-	0.02	0.04	0.03	$\pm 0.20$	$\pm 0.10$	$\pm 0.05$
$I_{max}$	-	-0.02	-0.03	-0.02	$\pm 0.20$	$\pm 0.10$	$\pm 0.05$
$I_{tr}$	0.5ind	0.00	-0.01	-0.01	$\pm 0.20$	$\pm 0.10$	$\pm 0.05$
10 $I_{tr}(I_{ref})$	-	0.00	0.00	0.01	$\pm 0.20$	$\pm 0.10$	$\pm 0.05$
0.5 $I_{max}$	-	0.02	0.03	0.03	$\pm 0.20$	$\pm 0.10$	$\pm 0.05$
$I_{max}$	-	-0.03	0.01	0.02	$\pm 0.20$	$\pm 0.10$	$\pm 0.05$
$I_{tr}$	0.8cap	-0.02	-0.02	0.00	$\pm 0.20$	$\pm 0.10$	$\pm 0.05$
10 $I_{tr}(I_{ref})$	-	0.00	0.00	0.00	$\pm 0.20$	$\pm 0.10$	$\pm 0.05$
0.5 $I_{max}$	-	0.00	0.00	0.01	$\pm 0.20$	$\pm 0.10$	$\pm 0.05$
$I_{max}$	-	-0.01	-0.01	-0.04	$\pm 0.20$	$\pm 0.10$	$\pm 0.05$



**Variation in Current (cont.)**

X-Ref. 8.7.2

Sample No: SHES2207013595MI-M4	Test Procedure: EN50470-3 Acc 1P2W kWh -P
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Test Conditions:  $Un: 230V$   $Fn: 50Hz$   
 $Imin: 0.1A$   $Itr: 1A$   $Iref: 10A$   $Imax: 80A$

Test Circuit: *1 phase 2 wire(only L1)*

Measurement Mode: *Active Export Energy kWh*

CURRENT	PF Cos. $\phi$	% Error	Limit of % Error		
			Accuracy		
			Class A	Class B	Class C
$Imin$	1.0	-0.70	$\pm 2.5$	$\pm 1.5$	$\pm 1.0$
$Itr$	-	-0.44	$\pm 2.0$	$\pm 1.0$	$\pm 0.5$
$10Itr(Iref)$	-	-0.22	$\pm 2.0$	$\pm 1.0$	$\pm 0.5$
$0.5Imax$	-	-0.25	$\pm 2.0$	$\pm 1.0$	$\pm 0.5$
$Imax$	-	-0.05	$\pm 2.0$	$\pm 1.0$	$\pm 0.5$
$Itr$	0.5ind	-0.48	$\pm 2.0$	$\pm 1.0$	$\pm 0.5$
$10Itr(Iref)$	-	-0.40	$\pm 2.0$	$\pm 1.0$	$\pm 0.5$
$0.5Imax$	-	-0.32	$\pm 2.0$	$\pm 1.0$	$\pm 0.5$
$Imax$	-	-0.23	$\pm 2.0$	$\pm 1.0$	$\pm 0.5$
$Itr$	0.8cap	-0.38	$\pm 2.0$	$\pm 1.0$	$\pm 0.5$
$10Itr(Iref)$	-	-0.08	$\pm 2.0$	$\pm 1.0$	$\pm 0.5$
$0.5Imax$	-	-0.04	$\pm 2.0$	$\pm 1.0$	$\pm 0.5$
$Imax$	-	-0.09	$\pm 2.0$	$\pm 1.0$	$\pm 0.5$

**Repeatability**

EN50470-3 X-Ref 8.2

CURRENT	PF Cos. $\phi$	$R1$	$R2$	$R3$	Limit of % Error Variation		
		% Error Variance	% Error Variance	% Error Variance	Accuracy		
					Class A	Class B	Class C
$Imin$	1.0	0.00	-0.01	-0.01	$\pm 0.25$	$\pm 0.15$	$\pm 0.10$
$Itr$	-	0.00	-0.01	-0.01	$\pm 0.20$	$\pm 0.10$	$\pm 0.05$
$10Itr(Iref)$	-	0.01	0.02	0.02	$\pm 0.20$	$\pm 0.10$	$\pm 0.05$
$0.5Imax$	-	0.00	0.02	0.03	$\pm 0.20$	$\pm 0.10$	$\pm 0.05$
$Imax$	-	0.00	-0.03	-0.04	$\pm 0.20$	$\pm 0.10$	$\pm 0.05$
$Itr$	0.5ind	-0.01	-0.01	-0.02	$\pm 0.20$	$\pm 0.10$	$\pm 0.05$
$10Itr(Iref)$	-	0.00	0.00	0.00	$\pm 0.20$	$\pm 0.10$	$\pm 0.05$
$0.5Imax$	-	0.00	0.01	0.01	$\pm 0.20$	$\pm 0.10$	$\pm 0.05$
$Imax$	-	0.01	-0.02	-0.03	$\pm 0.20$	$\pm 0.10$	$\pm 0.05$
$Itr$	0.8cap	-0.01	0.00	0.00	$\pm 0.20$	$\pm 0.10$	$\pm 0.05$
$10Itr(Iref)$	-	-0.01	0.00	0.00	$\pm 0.20$	$\pm 0.10$	$\pm 0.05$
$0.5Imax$	-	0.01	0.01	0.00	$\pm 0.20$	$\pm 0.10$	$\pm 0.05$
$Imax$	-	-0.02	-0.04	-0.03	$\pm 0.20$	$\pm 0.10$	$\pm 0.05$

## 2.2 Meter Constant

X-Ref 8.7.10

The relation between the test output and the meter energy registers were checked to ensure the constant marking on the meter nameplate.

Sample No: M12	Test Procedure: EN50470-3 Meter Constant (1h @ Im)
----------------	--

Test Conditions:  $U_n: 3x230/400V$   $I_{max}: 80A$   $Cos. \phi = 1.0, 50Hz$

Test Circuit:  $3\ phase\ 4\ wire$

Measurement Mode: *Active Import Energy kWh*

Number of Pulses Recorded	Pulse Constant (p/ kWh)	LED Test Output (kWh)	Energy Registered By Meter (kWh)	Percentage difference between Energy Registered and LED Test Output (%)
7992	400	19.98	19.98	0.00

Limit of % Error Variation:  $\pm 0.20\%$  for Class A  
 $\pm 0.10\%$  for Class B  
 $\pm 0.05\%$  for Class C

During the registration tests, rate registers not active were found not to have been corrupted.

Sample No: M12	Test Procedure: EN50470-3 Meter Constant (1h @ Im)
----------------	--

Test Conditions:  $U_n: 3x230/400V$   $I_{max}: 80A$   $Cos. \phi = 1.0, 50Hz$

Test Circuit:  $3\ phase\ 4\ wire$

Measurement Mode: *Active Export Energy kWh*

Number of Pulses Recorded	Pulse Constant (p/ kWh)	LED Test Output (kWh)	Energy Registered By Meter (kWh)	Percentage difference between Energy Registered and LED Test Output (%)
8005	400	20.0125	20.01	-0.01

Limit of % Error Variation:  $\pm 0.20\%$  for Class A  
 $\pm 0.10\%$  for Class B  
 $\pm 0.05\%$  for Class C

During the registration tests, rate registers not active were found not to have been corrupted.



## 2.3 Starting and No-Load Condition

X-Ref. 8.7.9

### Initial Start-up of the meter

X-Ref. 8.7.9.2

Sample No: M12

Test Procedure: EN50470-3 Start-up

The meter samples were fully functional within 5s after rated voltage  $U_n$  was applied to the meter terminals.

### No-load Condition

X-Ref. 8.7.9.3

Sample No: M12

Test Procedure: EN50470-3 Non Registration Test 115(%U)

Tests were conducted as follows;

Test Conditions: *115%  $U_n$ , current circuits open*

The minimum test duration in minutes being given by

$$\Delta t \geq \frac{240 \times 10^3}{k \cdot m \cdot U_{\text{test}} \cdot I_{\text{st}}} \text{ [min]}$$

where

$k$  is the meter output constant (pulses per kWh )

$m$  is the number of measuring elements

$U_{\text{test}}$  is the test voltage

$I_{\text{st}}$  is the starting current

The meter samples were tested for a period of at least  $\Delta t$  minutes, on completion of which, no changes in the energy registers were recorded, and the test output did not produce more than one pulse.



## Starting and No-Load Condition (cont.)

### Starting

X-Ref. 8.7.9.4

Sample No: M12

Test Procedure: EN50470-3 Starting Current 0.04Itr

The meter commenced and continued to measure the applied active power in the import and export direction.

#### Test Conditions for Direct Connected meters

Class A Active meters: Umin, 0.05Itr, Cos.  $\phi = 1.0$ , 50Hz

Class B Active meters: Umin, 0.04Itr, Cos.  $\phi = 1.0$ , 50Hz

Class C Active meters: Umin, 0.04Itr, Cos.  $\phi = 1.0$ , 50Hz

#### Test Conditions for Transformer Operated meters

Class A Active meters: Umin, 0.06Itr, Cos.  $\phi = 1.0$ , 50Hz

Class B Active meters: Umin, 0.04Itr, Cos.  $\phi = 1.0$ , 50Hz

Class C Active meters: Umin, 0.02Itr, Cos.  $\phi = 1.0$ , 50Hz

## 2.4 Influence of Ambient Temperature

X-Ref. 8.7.5.2

Sample No: M12

Test Procedure: EN50470-3 Temp Variation 5°C to 30°C

Test Conditions:  $U_n: 3 \times 230/400V$   $F_n: 50Hz$   
 $I_{min}: 0.1A$   $I_{tr}: 1A$   $I_{ref}: 10A$   $I_{max}: 80A$

Test Circuit: *3 phase 4 wire*

Measurement Mode: *Active Import Energy kWh*

Operating Temperature: *5°C to 30°C (Balanced Load)*

Elements/Lines		Additional % Error	Additional % Error	Limits of additional % error		
CURRENT	PF Cos. $\phi$	5°C	30°C	Accuracy		
				Class A	Class B	Class C
$I_{min}$	1.0	0.13	-0.09	±1.8	±0.9	±0.5
$I_{tr}$	-	0.09	-0.04	±1.8	±0.9	±0.5
10 $I_{tr}(I_{ref})$	-	0.07	-0.04	±1.8	±0.9	±0.5
$I_{max}$	-	0.08	-0.08	±1.8	±0.9	±0.5
$I_{tr}$	0.5ind	0.16	-0.08	±2.7	±1.3	±0.9
10 $I_{tr}(I_{ref})$	-	0.10	-0.05	±2.7	±1.3	±0.9
$I_{max}$	-	0.10	-0.06	±2.7	±1.3	±0.9
$I_{tr}$	0.8cap	0.06	-0.03	±2.7	±1.3	±0.9
10 $I_{tr}(I_{ref})$	-	0.06	-0.03	±2.7	±1.3	±0.9
$I_{max}$	-	0.09	-0.03	±2.7	±1.3	±0.9

**Influence of Ambient Temperature (cont.)**

X-Ref. 8.7.5.2

Sample No: M12	Test Procedure: EN50470-3 Temp Variation 5°C to 30°C
----------------	--

**Polyphase meter carrying a single-phase load, with balanced voltage applied to the voltage circuits.**

Operating Temperature 5°C							
Elements/Lines		I1 Element L1	I2 Element L2	I3 Element L3	Limit of additional % error		
CURRENT	PF Cos. $\phi$	<i>Additional % Error</i>	<i>Additional % Error</i>	<i>Additional % Error</i>	Accuracy		
Itr	1.0	0.11	0.10	0.07	Class A ±1.8	Class B ±0.9	Class C ±0.5
10Itr(Iref/In)	-	0.08	0.09	0.06	±1.8	±0.9	±0.5
I <sub>max</sub>	-	0.10	0.08	0.07	±1.8	±0.9	±0.5
Itr	0.5ind	0.19	0.16	0.16	±2.7	±1.3	±0.9
10Itr(Iref/In)	-	0.08	0.14	0.07	±2.7	±1.3	±0.9
I <sub>max</sub>	-	0.06	0.06	0.01	±2.7	±1.3	±0.9

Operating Temperature 30°C							
Elements/Lines		I1 Element L1	I2 Element L2	I3 Element L3	Limit of additional % error		
CURRENT	PF Cos. $\phi$	<i>Additional % Error</i>	<i>Additional % Error</i>	<i>Additional % Error</i>	Accuracy		
Itr	1.0	-0.05	-0.04	-0.03	Class A ±1.8	Class B ±0.9	Class C ±0.5
10Itr(Iref/In)	-	-0.04	-0.04	-0.02	±1.8	±0.9	±0.5
I <sub>max</sub>	-	-0.02	-0.03	-0.01	±1.8	±0.9	±0.5
Itr	0.5ind	-0.12	-0.05	-0.06	±2.7	±1.3	±0.9
10Itr(Iref/In)	-	-0.08	-0.04	-0.05	±2.7	±1.3	±0.9
I <sub>max</sub>	-	-0.17	-0.09	-0.01	±2.7	±1.3	±0.9

## Influence of Ambient Temperature (cont.)

X-Ref. 8.7.5.2

Sample No: M12	Test Procedure: EN50470-3 Temp Variation -10°C to 40°C
----------------	--

Test Conditions:  $Un: 3x230/400V$   $Fn: 50Hz$   
 $Imin: 0.1A$   $Itr: 1A$   $Iref: 10A$   $Imax: 80A$

Test Circuit: *3 phase 4 wire*

Measurement Mode: *Active Import Energy kWh*

Operating Temperature: *-10°C to 40°C (Balanced Load)*

Elements/Lines		Additional % Error	Additional % Error	Limits of additional % error		
CURRENT	PF Cos. $\phi$	-10°C	40°C	Accuracy		
				Class A	Class B	Class C
Imin	1.0	0.32	-0.13	±3.3	±1.6	±1.0
Itr	-	0.23	-0.06	±3.3	±1.6	±1.0
10Itr(Iref)	-	0.20	-0.05	±3.3	±1.6	±1.0
Imax	-	0.23	-0.05	±3.3	±1.6	±1.0
Itr	0.5ind	0.39	-0.11	±4.9	±2.3	±1.6
10Itr(Iref)	-	0.26	-0.06	±4.9	±2.3	±1.6
Imax	-	0.31	-0.03	±4.9	±2.3	±1.6
Itr	0.8cap	0.18	-0.04	±4.9	±2.3	±1.6
10Itr(Iref)	-	0.18	-0.03	±4.9	±2.3	±1.6
Imax	-	0.24	-0.04	±4.9	±2.3	±1.6

**Influence of Ambient Temperature (cont.)**

X-Ref. 8.7.5.2

Sample No: M12	Test Procedure: EN50470-3 Temp Variation -10°C to 40°C
----------------	--

**Polyphase meter carrying a single-phase load, with balanced voltage applied to the voltage circuits.**

Operating Temperature -10°C							
Elements/Lines		I1 Element L1	I2 Element L2	I3 Element L3	Limit of additional % error		
CURRENT	PF Cos. $\phi$	<i>Additional % Error</i>	<i>Additional % Error</i>	<i>Additional % Error</i>	Accuracy		
Itr	1.0	0.28	0.24	0.20	Class A ±3.3	Class B ±1.6	Class C ±1.0
10Itr(Iref/In)	-	0.23	0.23	0.17	±3.3	±1.6	±1.0
I <sub>max</sub>	-	0.27	0.26	0.20	±3.3	±1.6	±1.0
Itr	0.5ind	0.45	0.38	0.36	±4.9	±2.3	±1.6
10Itr(Iref/In)	-	0.26	0.32	0.22	±4.9	±2.3	±1.6
I <sub>max</sub>	-	0.31	0.18	0.14	±4.9	±2.3	±1.6

Operating Temperature 40°C							
Elements/Lines		I1 Element L1	I2 Element L2	I3 Element L3	Limit of additional % error		
CURRENT	PF Cos. $\phi$	<i>Additional % Error</i>	<i>Additional % Error</i>	<i>Additional % Error</i>	Accuracy		
Itr	1.0	-0.09	-0.05	-0.02	Class A ±3.3	Class B ±1.6	Class C ±1.0
10Itr(Iref/In)	-	-0.05	-0.06	-0.02	±3.3	±1.6	±1.0
I <sub>max</sub>	-	-0.05	-0.05	-0.02	±3.3	±1.6	±1.0
Itr	0.5ind	-0.20	-0.03	-0.10	±4.9	±2.3	±1.6
10Itr(Iref/In)	-	-0.11	-0.04	-0.05	±4.9	±2.3	±1.6
I <sub>max</sub>	-	-0.16	-0.12	0.01	±4.9	±2.3	±1.6

## Influence of Ambient Temperature (cont.)

X-Ref. 8.7.5.2

Sample No: M12

Test Procedure: EN50470-3 Temp Variation -25°C to 55°C

Test Conditions:  $U_n: 3 \times 230/400V$   $F_n: 50Hz$   
 $I_{min}: 0.1A$   $I_{tr}: 1A$   $I_{ref}: 10A$   $I_{max}: 80A$

Test Circuit: *3 phase 4 wire*

Measurement Mode: *Active Import Energy kWh*

Operating Temperature: *-25°C to 55°C (Balanced Load)*

Elements/Lines		Additional % Error	Additional % Error	Limits of additional % error		
CURRENT	PF Cos. $\phi$	-25°C	55°C	Accuracy		
				Class A	Class B	Class C
$I_{min}$	1.0	0.56	-0.18	±4.8	±2.4	±1.4
$I_{tr}$	-	0.45	-0.04	±4.8	±2.4	±1.4
10 $I_{tr}(I_{ref})$	-	0.40	-0.02	±4.8	±2.4	±1.4
$I_{max}$	-	0.43	-0.04	±4.8	±2.4	±1.4
$I_{tr}$	0.5ind	0.69	-0.11	±7.2	±3.4	±3.1
10 $I_{tr}(I_{ref})$	-	0.48	-0.04	±7.2	±3.4	±3.1
$I_{max}$	-	0.52	-0.01	±7.2	±3.4	±3.1
$I_{tr}$	0.8cap	0.36	-0.03	±7.2	±3.4	±3.1
10 $I_{tr}(I_{ref})$	-	0.37	-0.01	±7.2	±3.4	±3.1
$I_{max}$	-	0.39	-0.01	±7.2	±3.4	±3.1

**Influence of Ambient Temperature (cont.)**

X-Ref. 8.7.5.2

Sample No: M12	Test Procedure: EN50470-3 Temp Variation -25°C to 55°C
----------------	--

**Polyphase meter carrying a single-phase load, with balanced voltage applied to the voltage circuits.**

Operating Temperature -25°C							
Elements/Lines		I1 Element L1	I2 Element L2	I3 Element L3	Limit of additional % error		
CURRENT	PF Cos. $\phi$	<i>Additional % Error</i>	<i>Additional % Error</i>	<i>Additional % Error</i>	Accuracy		
Itr	1.0	0.51	-0.39	0.46	Class A ±4.8	Class B ±2.4	Class C ±1.4
10Itr(Iref/In)	-	0.45	-0.42	0.44	±4.8	±2.4	±1.4
I <sub>max</sub>	-	0.48	-0.35	0.44	±4.8	±2.4	±1.4
Itr	0.5ind	0.79	-0.43	0.69	±7.2	±3.4	±3.1
10Itr(Iref/In)	-	0.50	-0.33	0.56	±7.2	±3.4	±3.1
I <sub>max</sub>	-	0.71	-0.24	0.43	±7.2	±3.4	±3.1

Operating Temperature 55°C							
Elements/Lines		I1 Element L1	I2 Element L2	I3 Element L3	Limit of additional % error		
CURRENT	PF Cos. $\phi$	<i>Additional % Error</i>	<i>Additional % Error</i>	<i>Additional % Error</i>	Accuracy		
Itr	1.0	-0.10	0.18	-0.04	Class A ±4.8	Class B ±2.4	Class C ±1.4
10Itr(Iref/In)	-	-0.04	-0.01	-0.05	±4.8	±2.4	±1.4
I <sub>max</sub>	-	-0.06	-0.01	-0.04	±4.8	±2.4	±1.4
Itr	0.5ind	-0.28	0.17	0.06	±7.2	±3.4	±3.1
10Itr(Iref/In)	-	-0.13	0.14	0.02	±7.2	±3.4	±3.1
I <sub>max</sub>	-	-0.14	0.02	-0.07	±7.2	±3.4	±3.1



**Influence of Ambient Temperature (cont.)**

X-Ref. 8.7.5.2

Sample No: M12	Test Procedure: EN50470-3 Temp Variation -40°C to 70°C
----------------	--

Test Conditions:  $Un: 3x230/400V$   $Fn: 50Hz$   
 $Imin: 0.1A$   $Itr: 1A$   $Iref: 10A$   $Imax: 80A$

Test Circuit: *3 phase 4 wire*

Measurement Mode: *Active Import Energy kWh*

Operating Temperature: *-40°C to 70°C (Balanced Load)*

Elements/Lines		Additional % Error	Additional % Error	Limits of additional % error		
CURRENT	PF Cos. $\phi$	-40°C	70°C	Accuracy		
				Class A	Class B	Class C
Imin	1.0	0.86	-0.26	±6.3	±3.1	±1.9
Itr	-	0.74	0.00	±6.3	±3.1	±1.9
10Itr(Iref/In)	-	0.68	0.04	±6.3	±3.1	±1.9
Imax	-	0.69	0.01	±6.3	±3.1	±1.9
Itr	0.5ind	1.09	-0.05	±9.4	±4.4	±3.1
10Itr(Iref/In)	-	0.78	0.03	±9.4	±4.4	±3.1
Imax	-	0.91	0.11	±9.4	±4.4	±3.1
Itr	0.8cap	0.60	0.00	±9.4	±4.4	±3.1
10Itr(Iref/In)	-	0.64	0.04	±9.4	±4.4	±3.1
Imax	-	0.62	0.01	±9.4	±4.4	±3.1

**Influence of Ambient Temperature (cont.)**

X-Ref. 8.7.5.2

Sample No: M12	Test Procedure: EN50470-3 Temp Variation -40°C to 70°C
----------------	--

**Polyphase meter carrying a single-phase load, with balanced voltage applied to the voltage circuits.**

Operating Temperature -40°C							
Elements/Lines		I1 Element L1	I2 Element L2	I3 Element L3	Limit of additional % error		
CURRENT	PF Cos. $\phi$	<i>Additional % Error</i>	<i>Additional % Error</i>	<i>Additional % Error</i>	Accuracy		
Itr	1.0	0.82	0.75	0.65	Class A ±6.3	Class B ±3.1	Class C ±1.9
10Itr(Iref/In)	-	0.75	0.71	0.61	±6.3	±3.1	±1.9
I <sub>max</sub>	-	0.76	0.78	0.64	±6.3	±3.1	±1.9
Itr	0.5ind	1.21	0.10	0.98	±9.4	±4.4	±3.1
10Itr(Iref/In)	-	0.81	0.85	0.68	±9.4	±4.4	±3.1
I <sub>max</sub>	-	1.18	0.72	0.73	±9.4	±4.4	±3.1

Operating Temperature 70°C							
Elements/Lines		I1 Element L1	I2 Element L2	I3 Element L3	Limit of additional % error		
CURRENT	PF Cos. $\phi$	<i>Additional % Error</i>	<i>Additional % Error</i>	<i>Additional % Error</i>	Accuracy		
Itr	1.0	-0.09	0.01	0.08	Class A ±6.3	Class B ±3.1	Class C ±1.9
10Itr(Iref/In)	-	0.00	0.00	0.10	±6.3	±3.1	±1.9
I <sub>max</sub>	-	0.00	0.01	0.07	±6.3	±3.1	±1.9
Itr	0.5ind	-0.31	0.19	-0.05	±9.4	±4.4	±3.1
10Itr(Iref/In)	-	-0.08	0.12	0.02	±9.4	±4.4	±3.1
I <sub>max</sub>	-	-0.05	0.01	0.15	±9.4	±4.4	±3.1

## 2.5 Voltage Variation

X-Ref. 8.7.5.3

Sample No: M12	Test Procedure: EN50470-3 Voltage Variation
----------------	---

Test Conditions:  $Un: 3x230/400V$   $Fn: 50Hz$   
 $I_{min}: 0.1A$   $I_{tr}: 1A$   $I_{ref}: 10A$   $I_{max}: 80A$

Test Circuit: *3 phase 4 wire*

Measurement Mode: *Active Import Energy kWh*

		110% Un Additional	90% Un Additional	Limit of Additional % Error		
Current	PF Cos. $\phi$	% Error	% Error	Accuracy		
				Class A	Class B	Class C
$I_{min}$	1.0	-0.08	0.01	$\pm 1.0$	$\pm 0.7$	$\pm 0.2$
$I_{tr}$	-	-0.03	-0.03	$\pm 1.0$	$\pm 0.7$	$\pm 0.2$
$10I_{tr}(I_{ref})$	-	-0.03	-0.04	$\pm 1.0$	$\pm 0.7$	$\pm 0.2$
$I_{max}$	-	-0.02	-0.08	$\pm 1.0$	$\pm 0.7$	$\pm 0.2$
$I_{tr}$	0.5ind	-0.04	-0.04	$\pm 1.5$	$\pm 1.0$	$\pm 0.4$
$10I_{tr}(I_{ref})$	-	-0.02	-0.04	$\pm 1.5$	$\pm 1.0$	$\pm 0.4$
$I_{max}$	-	0.03	-0.02	$\pm 1.5$	$\pm 1.0$	$\pm 0.4$
$I_{tr}$	0.8cap	-0.03	-0.03	$\pm 1.5$	$\pm 1.0$	$\pm 0.4$
$10I_{tr}(I_{ref})$	-	-0.02	-0.03	$\pm 1.5$	$\pm 1.0$	$\pm 0.4$
$I_{max}$	-	-0.04	-0.05	$\pm 1.5$	$\pm 1.0$	$\pm 0.4$

**Polyphase meter carrying a single-phase load, with balanced voltage applied to the voltage circuits.**

110% Un							
Elements/Lines		I1 Element L1	I2 Element L2	I3 Element L3	Limit of additional % error		
CURRENT	PF Cos. $\phi$	<i>Additional % Error</i>	<i>Additional % Error</i>	<i>Additional % Error</i>	Accuracy		
Itr	1.0	-0.04	-0.02	-0.01	Class A $\pm 1.5$	Class B $\pm 1.0$	Class C $\pm 0.3$
10Itr(Iref/In)	-	-0.03	-0.02	-0.01	$\pm 1.5$	$\pm 1.0$	$\pm 0.3$
I <sub>max</sub>	-	0.02	0.01	0.00	$\pm 1.5$	$\pm 1.0$	$\pm 0.3$
Itr	0.5ind	-0.06	-0.03	0.00	$\pm 2.0$	$\pm 1.5$	$\pm 0.5$
10Itr(Iref/In)	-	-0.04	-0.02	-0.01	$\pm 2.0$	$\pm 1.5$	$\pm 0.5$
I <sub>max</sub>	-	-0.01	-0.07	-0.04	$\pm 2.0$	$\pm 1.5$	$\pm 0.5$

90% Un							
Elements/Lines		I1 Element L1	I2 Element L2	I3 Element L3	Limit of additional % error		
CURRENT	PF Cos. $\phi$	<i>Additional % Error</i>	<i>Additional % Error</i>	<i>Additional % Error</i>	Accuracy		
Itr	1.0	-0.03	-0.03	-0.02	Class A $\pm 1.5$	Class B $\pm 1.0$	Class C $\pm 0.3$
10Itr(Iref/In)	-	-0.04	-0.03	-0.03	$\pm 1.5$	$\pm 1.0$	$\pm 0.3$
I <sub>max</sub>	-	-0.01	-0.02	-0.04	$\pm 1.5$	$\pm 1.0$	$\pm 0.3$
Itr	0.5ind	-0.02	-0.04	-0.02	$\pm 2.0$	$\pm 1.5$	$\pm 0.5$
10Itr(Iref/In)	-	-0.06	-0.04	-0.05	$\pm 2.0$	$\pm 1.5$	$\pm 0.5$
I <sub>max</sub>	-	-0.04	-0.03	-0.03	$\pm 2.0$	$\pm 1.5$	$\pm 0.5$

## 2.6 Frequency Variation

X-Ref. 8.7.5.4

Sample No: M12

Test Procedure: EN50470-3 Frequency Variation

Test Conditions:  $Un: 3x230/400V$   $Fn: 50Hz$   
 $I_{min}: 0.1A$   $I_{tr}: 1A$   $I_{ref}: 10A$   $I_{max}: 80A$

Test Circuit: *3 phase 4 wire*

Measurement Mode: *Active Import Energy kWh*

		102% Fn Additional	98% Fn Additional	Limit of Additional % Error		
Current	PF Cos. $\phi$	% Error	% Error	Accuracy		
				Class A	Class B	Class C
$I_{min}$	1.0	-0.03	-0.01	$\pm 0.8$	$\pm 0.5$	$\pm 0.2$
$I_{tr}$	-	-0.02	-0.02	$\pm 0.8$	$\pm 0.5$	$\pm 0.2$
$10I_{tr}(I_{ref})$	-	-0.02	-0.02	$\pm 0.8$	$\pm 0.5$	$\pm 0.2$
$I_{max}$	-	-0.03	-0.03	$\pm 0.8$	$\pm 0.5$	$\pm 0.2$
$I_{tr}$	0.5ind	-0.03	0.00	$\pm 1.0$	$\pm 0.7$	$\pm 0.2$
$10I_{tr}(I_{ref})$	-	-0.02	-0.01	$\pm 1.0$	$\pm 0.7$	$\pm 0.2$
$I_{max}$	-	0.01	0.03	$\pm 1.0$	$\pm 0.7$	$\pm 0.2$
$I_{tr}$	0.8cap	-0.02	-0.02	$\pm 1.0$	$\pm 0.7$	$\pm 0.2$
$10I_{tr}(I_{ref})$	-	-0.02	-0.02	$\pm 1.0$	$\pm 0.7$	$\pm 0.2$
$I_{max}$	-	-0.02	-0.03	$\pm 1.0$	$\pm 0.7$	$\pm 0.2$

**Polyphase meter carrying a single-phase load, with balanced voltage applied to the voltage circuits.**

102% Fn							
Elements/Lines		I1 Element L1	I2 Element L2	I3 Element L3	Limit of additional % error		
CURRENT	PF Cos. $\phi$	<i>Additional % Error</i>	<i>Additional % Error</i>	<i>Additional % Error</i>	Accuracy		
Itr	1.0	-0.02	-0.02	-0.01	Class A $\pm 1.0$	Class B $\pm 0.7$	Class C $\pm 0.3$
10Itr(Iref/In)	-	-0.02	-0.02	-0.01	$\pm 1.0$	$\pm 0.7$	$\pm 0.3$
I <sub>max</sub>	-	-0.01	0.02	-0.02	$\pm 1.0$	$\pm 0.7$	$\pm 0.3$
Itr	0.5ind	-0.02	-0.02	0.00	$\pm 1.3$	$\pm 1.0$	$\pm 0.3$
10Itr(Iref/In)	-	-0.03	-0.02	-0.01	$\pm 1.3$	$\pm 1.0$	$\pm 0.3$
I <sub>max</sub>	-	-0.01	-0.01	-0.09	$\pm 1.3$	$\pm 1.0$	$\pm 0.3$

98% Fn							
Elements/Lines		I1 Element L1	I2 Element L2	I3 Element L3	Limit of additional % error		
CURRENT	PF Cos. $\phi$	<i>Additional % Error</i>	<i>Additional % Error</i>	<i>Additional % Error</i>	Accuracy		
Itr	1.0	-0.01	-0.02	-0.01	Class A $\pm 1.0$	Class B $\pm 0.7$	Class C $\pm 0.3$
10Itr(Iref/In)	-	-0.03	-0.01	-0.02	$\pm 1.0$	$\pm 0.7$	$\pm 0.3$
I <sub>max</sub>	-	-0.01	-0.02	-0.05	$\pm 1.0$	$\pm 0.7$	$\pm 0.3$
Itr	0.5ind	0.01	-0.01	0.01	$\pm 1.3$	$\pm 1.0$	$\pm 0.3$
10Itr(Iref/In)	-	-0.02	-0.01	-0.01	$\pm 1.3$	$\pm 1.0$	$\pm 0.3$
I <sub>max</sub>	-	0.02	-0.01	0.02	$\pm 1.3$	$\pm 1.0$	$\pm 0.3$



## 2.7 Composite Error

X-Ref. 8.7.6

In addition to the accuracy requirements of clause 8.1 and 8.3, the composite error  $e_c$  of the meter shall not exceed the values given below:

		Intrinsic Error	Temp. Error	Voltage Error	Freq. Error	Comp. Error	Operating Temperature -40°C		
Current	PF Cos. $\phi$	$e(I\cos\phi)$	-40°C $e(TI\cos\phi)$	$\pm 10\% U_n$ $e(UI\cos\phi)$	$\pm 2\% f_n$ $e(fI\cos\phi)$	% MPE	Maximum Permissible Error (MPE)		
							Class A	Class B	Class C
I <sub>min</sub>	1.0	-0.40	0.86	-0.08	-0.03	$\pm 0.95$	$\pm 9.0$	$\pm 4.0$	$\pm 2.0$
I <sub>tr</sub>	-	0.02	0.74	-0.03	-0.02	$\pm 0.74$	$\pm 9.0$	$\pm 4.0$	$\pm 2.0$
10I <sub>tr</sub>	-	0.03	0.68	-0.04	-0.02	$\pm 0.68$	$\pm 9.0$	$\pm 4.0$	$\pm 2.0$
I <sub>max</sub>	-	-0.08	0.69	-0.08	-0.03	$\pm 0.70$	$\pm 9.0$	$\pm 4.0$	$\pm 2.0$
I <sub>tr</sub>	0.5ind	0.09	1.09	-0.04	-0.03	$\pm 1.09$	$\pm 9.0$	$\pm 4.0$	$\pm 1.5$
10I <sub>tr</sub>	-	0.02	0.78	-0.04	-0.02	$\pm 0.78$	$\pm 9.0$	$\pm 4.0$	$\pm 1.5$
I <sub>max</sub>	-	0.18	0.91	0.03	0.03	$\pm 0.93$	$\pm 9.0$	$\pm 4.0$	$\pm 1.5$
I <sub>tr</sub>	0.8cap	-0.04	0.60	-0.03	-0.02	$\pm 0.60$	$\pm 9.0$	$\pm 4.0$	$\pm 1.5$
10I <sub>tr</sub>	-	0.02	0.64	-0.03	-0.02	$\pm 0.64$	$\pm 9.0$	$\pm 4.0$	$\pm 1.5$
I <sub>max</sub>	-	-0.25	0.62	-0.05	-0.03	$\pm 0.67$	$\pm 9.0$	$\pm 4.0$	$\pm 1.5$

**Composite Error/MPE (cont.)**

X-Ref. 8.7.6

**Polyphase meter carrying a single-phase load, with balanced voltage applied to the voltage circuits.**

		Intrinsic Error	Temp. Error	Voltage Error	Freq. Error	Comp. Error	Operating Temperature -40°C		
Current	PF Cos. $\phi$	$e(I\cos\phi)$	-40°C $e(TI\cos\phi)$	$\pm 10\% U_n$ $e(UI\cos\phi)$	$\pm 2\% f_n$ $e(fI\cos\phi)$	% MPE	Maximum Permissible Error (MPE) Line 1		
							Class A	Class B	Class C
Itr	1.0	0.08	0.82	-0.04	-0.02	$\pm 0.83$	$\pm 9.0$	$\pm 4.5$	$\pm 2.0$
10Itr	-	0.13	0.75	-0.04	-0.03	$\pm 0.76$	$\pm 9.0$	$\pm 4.5$	$\pm 2.0$
Imax	-	0.16	0.76	0.02	-0.01	$\pm 0.78$	$\pm 9.0$	$\pm 4.5$	$\pm 2.0$
Itr	0.5ind	0.09	1.21	-0.06	-0.02	$\pm 1.21$	$\pm 9.0$	$\pm 4.5$	$\pm 2.0$
10Itr	-	0.24	0.81	-0.06	-0.03	$\pm 0.85$	$\pm 9.0$	$\pm 4.5$	$\pm 2.0$
Imax	-	0.20	1.18	-0.04	0.02	$\pm 1.20$	$\pm 9.0$	$\pm 4.5$	$\pm 2.0$

		Intrinsic Error	Temp. Error	Voltage Error	Freq. Error	Comp. Error	Operating Temperature -40°C		
Current	PF Cos. $\phi$	$e(I\cos\phi)$	-40°C $e(TI\cos\phi)$	$\pm 10\% U_n$ $e(UI\cos\phi)$	$\pm 2\% f_n$ $e(fI\cos\phi)$	% MPE	Maximum Permissible Error (MPE) Line 2		
							Class A	Class B	Class C
Itr	1.0	0.06	0.75	-0.03	-0.02	$\pm 0.75$	$\pm 9.0$	$\pm 4.5$	$\pm 2.0$
10Itr	-	0.18	0.71	-0.04	-0.02	$\pm 0.73$	$\pm 9.0$	$\pm 4.5$	$\pm 2.0$
Imax	-	0.17	0.78	0.02	0.02	$\pm 0.80$	$\pm 9.0$	$\pm 4.5$	$\pm 2.0$
Itr	0.5ind	-0.07	0.10	-0.04	-0.02	$\pm 0.13$	$\pm 9.0$	$\pm 4.5$	$\pm 2.0$
10Itr	-	0.17	0.85	-0.04	-0.02	$\pm 0.87$	$\pm 9.0$	$\pm 4.5$	$\pm 2.0$
Imax	-	0.09	0.72	-0.07	-0.01	$\pm 0.73$	$\pm 9.0$	$\pm 4.5$	$\pm 2.0$

		Intrinsic Error	Temp. Error	Voltage Error	Freq. Error	Comp. Error	Operating Temperature -40°C		
Current	PF Cos. $\phi$	$e(I\cos\phi)$	-40°C $e(TI\cos\phi)$	$\pm 10\% U_n$ $e(UI\cos\phi)$	$\pm 2\% f_n$ $e(fI\cos\phi)$	% MPE	Maximum Permissible Error (MPE) Line 3		
							Class A	Class B	Class C
Itr	1.0	0.12	0.65	-0.02	-0.01	$\pm 0.66$	$\pm 9.0$	$\pm 4.5$	$\pm 2.0$
10Itr	-	0.32	0.61	-0.03	-0.02	$\pm 0.69$	$\pm 9.0$	$\pm 4.5$	$\pm 2.0$
Imax	-	0.25	0.64	-0.04	-0.05	$\pm 0.69$	$\pm 9.0$	$\pm 4.5$	$\pm 2.0$
Itr	0.5ind	-0.16	0.98	0.02	0.01	$\pm 0.99$	$\pm 9.0$	$\pm 4.5$	$\pm 2.0$
10Itr	-	0.28	0.68	-0.05	-0.01	$\pm 0.74$	$\pm 9.0$	$\pm 4.5$	$\pm 2.0$
Imax	-	0.22	0.73	-0.04	-0.09	$\pm 0.77$	$\pm 9.0$	$\pm 4.5$	$\pm 2.0$



**Composite Error/MPE (cont.)**

X-Ref. 8.7.6

		Intrinsic Error	Temp. Error	Voltage Error	Freq. Error	Comp. Error	Operating Temperature -25°C		
Current	PF Cos. $\phi$	$e(I\cos\phi)$	-25°C $e(TI\cos\phi)$	$\pm 10\% U_n$ $e(UI\cos\phi)$	$\pm 2\% f_n$ $e(fI\cos\phi)$	% MPE	Maximum Permissible Error (MPE)		
							Class A	Class B	Class C
I <sub>min</sub>	1.0	-0.40	0.56	-0.08	-0.03	$\pm 0.69$	$\pm 7.0$	$\pm 3.5$	$\pm 1.7$
I <sub>tr</sub>	-	0.02	0.45	-0.03	-0.02	$\pm 0.45$	$\pm 7.0$	$\pm 3.5$	$\pm 1.7$
10I <sub>tr</sub>	-	0.03	0.40	-0.04	-0.02	$\pm 0.40$	$\pm 7.0$	$\pm 3.5$	$\pm 1.7$
I <sub>max</sub>	-	-0.08	0.43	-0.08	-0.03	$\pm 0.45$	$\pm 7.0$	$\pm 3.5$	$\pm 1.7$
I <sub>tr</sub>	0.5ind	0.09	0.69	-0.04	-0.03	$\pm 0.70$	$\pm 7.0$	$\pm 3.5$	$\pm 1.3$
10I <sub>tr</sub>	-	0.02	0.48	-0.04	-0.02	$\pm 0.48$	$\pm 7.0$	$\pm 3.5$	$\pm 1.3$
I <sub>max</sub>	-	0.18	0.52	0.03	0.03	$\pm 0.55$	$\pm 7.0$	$\pm 3.5$	$\pm 1.3$
I <sub>tr</sub>	0.8cap	-0.04	0.36	-0.03	-0.02	$\pm 0.36$	$\pm 7.0$	$\pm 3.5$	$\pm 1.3$
10I <sub>tr</sub>	-	0.02	0.37	-0.03	-0.02	$\pm 0.37$	$\pm 7.0$	$\pm 3.5$	$\pm 1.3$
I <sub>max</sub>	-	-0.25	0.39	-0.05	-0.03	$\pm 0.47$	$\pm 7.0$	$\pm 3.5$	$\pm 1.3$

**Composite Error/MPE (cont.)**

X-Ref. 8.7.6

**Polyphase meter carrying a single-phase load, with balanced voltage applied to the voltage circuits.**

		Intrinsic Error	Temp. Error	Voltage Error	Freq. Error	Comp. Error	Operating Temperature -25°C		
Current	PF Cos. $\phi$	$e(I\cos\phi)$	-25°C $e(TI\cos\phi)$	$\pm 10\% U_n$ $e(UI\cos\phi)$	$\pm 2\% f_n$ $e(fI\cos\phi)$	% MPE	Maximum Permissible Error (MPE) Line 1		
							Class A	Class B	Class C
Itr	1.0	0.08	0.51	-0.04	-0.02	$\pm 0.52$	$\pm 7.0$	$\pm 4.0$	$\pm 1.7$
10Itr	-	0.13	0.45	-0.04	-0.03	$\pm 0.47$	$\pm 7.0$	$\pm 4.0$	$\pm 1.7$
Imax	-	0.16	0.48	0.02	-0.01	$\pm 0.51$	$\pm 7.0$	$\pm 4.0$	$\pm 1.7$
Itr	0.5ind	0.09	0.79	-0.06	-0.02	$\pm 0.80$	$\pm 7.0$	$\pm 4.0$	$\pm 1.7$
10Itr	-	0.24	0.50	-0.06	-0.03	$\pm 0.56$	$\pm 7.0$	$\pm 4.0$	$\pm 1.7$
Imax	-	0.20	0.71	-0.04	0.02	$\pm 0.74$	$\pm 7.0$	$\pm 4.0$	$\pm 1.7$

		Intrinsic Error	Temp. Error	Voltage Error	Freq. Error	Comp. Error	Operating Temperature -25°C		
Current	PF Cos. $\phi$	$e(I\cos\phi)$	-25°C $e(TI\cos\phi)$	$\pm 10\% U_n$ $e(UI\cos\phi)$	$\pm 2\% f_n$ $e(fI\cos\phi)$	% MPE	Maximum Permissible Error (MPE) Line 2		
							Class A	Class B	Class C
Itr	1.0	0.06	-0.39	-0.03	-0.02	$\pm 0.40$	$\pm 7.0$	$\pm 4.0$	$\pm 1.7$
10Itr	-	0.18	-0.42	-0.04	-0.02	$\pm 0.46$	$\pm 7.0$	$\pm 4.0$	$\pm 1.7$
Imax	-	0.17	-0.35	0.02	0.02	$\pm 0.39$	$\pm 7.0$	$\pm 4.0$	$\pm 1.7$
Itr	0.5ind	-0.07	-0.43	-0.04	-0.02	$\pm 0.44$	$\pm 7.0$	$\pm 4.0$	$\pm 1.7$
10Itr	-	0.17	-0.33	-0.04	-0.02	$\pm 0.37$	$\pm 7.0$	$\pm 4.0$	$\pm 1.7$
Imax	-	0.09	-0.24	-0.07	-0.01	$\pm 0.27$	$\pm 7.0$	$\pm 4.0$	$\pm 1.7$

		Intrinsic Error	Temp. Error	Voltage Error	Freq. Error	Comp. Error	Operating Temperature -25°C		
Current	PF Cos. $\phi$	$e(I\cos\phi)$	-25°C $e(TI\cos\phi)$	$\pm 10\% U_n$ $e(UI\cos\phi)$	$\pm 2\% f_n$ $e(fI\cos\phi)$	% MPE	Maximum Permissible Error (MPE) Line 3		
							Class A	Class B	Class C
Itr	1.0	0.12	0.46	-0.02	-0.01	$\pm 0.48$	$\pm 7.0$	$\pm 4.0$	$\pm 1.7$
10Itr	-	0.32	0.44	-0.03	-0.02	$\pm 0.55$	$\pm 7.0$	$\pm 4.0$	$\pm 1.7$
Imax	-	0.25	0.44	-0.04	-0.05	$\pm 0.51$	$\pm 7.0$	$\pm 4.0$	$\pm 1.7$
Itr	0.5ind	-0.16	0.69	0.02	0.01	$\pm 0.71$	$\pm 7.0$	$\pm 4.0$	$\pm 1.7$
10Itr	-	0.28	0.56	-0.05	-0.01	$\pm 0.63$	$\pm 7.0$	$\pm 4.0$	$\pm 1.7$
Imax	-	0.22	0.43	-0.04	-0.09	$\pm 0.49$	$\pm 7.0$	$\pm 4.0$	$\pm 1.7$

**Composite Error/MPE (cont.)**

X-Ref. 8.7.6

		Intrinsic Error	Temp. Error	Voltage Error	Freq. Error	Comp. Error	Operating Temperature -10°C		
Current	PF Cos. $\phi$	$e(I\cos\phi)$	-10°C $e(TI\cos\phi)$	$\pm 10\% U_n$ $e(UI\cos\phi)$	$\pm 2\% f_n$ $e(fI\cos\phi)$	% MPE	Maximum Permissible Error (MPE)		
							Class A	Class B	Class C
I <sub>min</sub>	1.0	-0.40	0.32	-0.08	-0.03	$\pm 0.52$	$\pm 5.0$	$\pm 2.5$	$\pm 1.3$
I <sub>tr</sub>	-	0.02	0.23	-0.03	-0.02	$\pm 0.23$	$\pm 5.0$	$\pm 2.5$	$\pm 1.3$
10I <sub>tr</sub>	-	0.03	0.20	-0.04	-0.02	$\pm 0.21$	$\pm 5.0$	$\pm 2.5$	$\pm 1.3$
I <sub>max</sub>	-	-0.08	0.23	-0.08	-0.03	$\pm 0.26$	$\pm 5.0$	$\pm 2.5$	$\pm 1.3$
I <sub>tr</sub>	0.5ind	0.09	0.39	-0.04	-0.03	$\pm 0.40$	$\pm 4.5$	$\pm 2.5$	$\pm 1.0$
10I <sub>tr</sub>	-	0.02	0.26	-0.04	-0.02	$\pm 0.26$	$\pm 4.5$	$\pm 2.5$	$\pm 1.0$
I <sub>max</sub>	-	0.18	0.31	0.03	0.03	$\pm 0.36$	$\pm 4.5$	$\pm 2.5$	$\pm 1.0$
I <sub>tr</sub>	0.8cap	-0.04	0.18	-0.03	-0.02	$\pm 0.19$	$\pm 4.5$	$\pm 2.5$	$\pm 1.0$
10I <sub>tr</sub>	-	0.02	0.18	-0.03	-0.02	$\pm 0.18$	$\pm 4.5$	$\pm 2.5$	$\pm 1.0$
I <sub>max</sub>	-	-0.25	0.24	-0.05	-0.03	$\pm 0.35$	$\pm 4.5$	$\pm 2.5$	$\pm 1.0$

**Polyphase meter carrying a single-phase load, with balanced voltage applied to the voltage circuits.**

		Intrinsic Error	Temp. Error	Voltage Error	Freq. Error	Comp. Error	Operating Temperature -10°C		
Current	PF Cos. $\phi$	$e(I\cos\phi)$	-10°C $e(TI\cos\phi)$	$\pm 10\% U_n$ $e(UI\cos\phi)$	$\pm 2\% f_n$ $e(fI\cos\phi)$	% MPE	Maximum Permissible Error (MPE) Line 1		
							Class A	Class B	Class C
Itr	1.0	0.08	0.28	-0.04	-0.02	$\pm 0.29$	$\pm 5.0$	$\pm 3.0$	$\pm 1.3$
10Itr	-	0.13	0.23	-0.04	-0.03	$\pm 0.27$	$\pm 5.0$	$\pm 3.0$	$\pm 1.3$
Imax	-	0.16	0.27	0.02	-0.01	$\pm 0.31$	$\pm 5.0$	$\pm 3.0$	$\pm 1.3$
Itr	0.5ind	0.09	0.45	-0.06	-0.02	$\pm 0.46$	$\pm 5.0$	$\pm 3.0$	$\pm 1.3$
10Itr	-	0.24	0.26	-0.06	-0.03	$\pm 0.36$	$\pm 5.0$	$\pm 3.0$	$\pm 1.3$
Imax	-	0.20	0.31	-0.04	0.02	$\pm 0.37$	$\pm 5.0$	$\pm 3.0$	$\pm 1.3$

		Intrinsic Error	Temp. Error	Voltage Error	Freq. Error	Comp. Error	Operating Temperature -10°C		
Current	PF Cos. $\phi$	$e(I\cos\phi)$	-10°C $e(TI\cos\phi)$	$\pm 10\% U_n$ $e(UI\cos\phi)$	$\pm 2\% f_n$ $e(fI\cos\phi)$	% MPE	Maximum Permissible Error (MPE) Line 2		
							Class A	Class B	Class C
Itr	1.0	0.06	0.24	-0.03	-0.02	$\pm 0.25$	$\pm 5.0$	$\pm 3.0$	$\pm 1.3$
10Itr	-	0.18	0.23	-0.04	-0.02	$\pm 0.30$	$\pm 5.0$	$\pm 3.0$	$\pm 1.3$
Imax	-	0.17	0.26	0.02	0.02	$\pm 0.31$	$\pm 5.0$	$\pm 3.0$	$\pm 1.3$
Itr	0.5ind	-0.07	0.38	-0.04	-0.02	$\pm 0.39$	$\pm 5.0$	$\pm 3.0$	$\pm 1.3$
10Itr	-	0.17	0.32	-0.04	-0.02	$\pm 0.37$	$\pm 5.0$	$\pm 3.0$	$\pm 1.3$
Imax	-	0.09	0.18	-0.07	-0.01	$\pm 0.21$	$\pm 5.0$	$\pm 3.0$	$\pm 1.3$

		Intrinsic Error	Temp. Error	Voltage Error	Freq. Error	Comp. Error	Operating Temperature -10°C		
Current	PF Cos. $\phi$	$e(I\cos\phi)$	-10°C $e(TI\cos\phi)$	$\pm 10\% U_n$ $e(UI\cos\phi)$	$\pm 2\% f_n$ $e(fI\cos\phi)$	% MPE	Maximum Permissible Error (MPE) Line 3		
							Class A	Class B	Class C
Itr	1.0	0.12	0.20	-0.02	-0.01	$\pm 0.23$	$\pm 5.0$	$\pm 3.0$	$\pm 1.3$
10Itr	-	0.32	0.17	-0.03	-0.02	$\pm 0.36$	$\pm 5.0$	$\pm 3.0$	$\pm 1.3$
Imax	-	0.25	0.20	-0.04	-0.05	$\pm 0.33$	$\pm 5.0$	$\pm 3.0$	$\pm 1.3$
Itr	0.5ind	-0.16	0.36	0.02	0.01	$\pm 0.39$	$\pm 5.0$	$\pm 3.0$	$\pm 1.3$
10Itr	-	0.28	0.22	-0.05	-0.01	$\pm 0.36$	$\pm 5.0$	$\pm 3.0$	$\pm 1.3$
Imax	-	0.22	0.14	-0.04	-0.09	$\pm 0.28$	$\pm 5.0$	$\pm 3.0$	$\pm 1.3$



**Composite Error/MPE (cont.)**

X-Ref. 8.7.6

		Intrinsic Error	Temp. Error	Voltage Error	Freq. Error	Comp. Error	Operating Temperature Range 5°C		
Current	PF Cos. $\phi$	$e(I\cos\phi)$	5°C $e(TI\cos\phi)$	$\pm 10\%$ Un $e(UI\cos\phi)$	$\pm 2\%$ fn $e(fI\cos\phi)$	% MPE	Maximum Permissible Error (MPE)		
							Class A	Class B	Class C
Imin	1.0	-0.40	0.13	-0.08	-0.03	$\pm 0.43$	$\pm 3.5$	$\pm 2.0$	$\pm 1.0$
Itr	-	0.02	0.09	-0.03	-0.02	$\pm 0.10$	$\pm 3.5$	$\pm 2.0$	$\pm 1.0$
10Itr	-	0.03	0.07	-0.04	-0.02	$\pm 0.09$	$\pm 3.5$	$\pm 2.0$	$\pm 1.0$
Imax	-	-0.08	0.08	-0.08	-0.03	$\pm 0.14$	$\pm 3.5$	$\pm 2.0$	$\pm 1.0$
Itr	0.5ind	0.09	0.16	-0.04	-0.03	$\pm 0.19$	$\pm 3.5$	$\pm 2.0$	$\pm 0.7$
10Itr	-	0.02	0.10	-0.04	-0.02	$\pm 0.11$	$\pm 3.5$	$\pm 2.0$	$\pm 0.7$
Imax	-	0.18	0.10	0.03	0.03	$\pm 0.21$	$\pm 3.5$	$\pm 2.0$	$\pm 0.7$
Itr	0.8cap	-0.04	0.06	-0.03	-0.02	$\pm 0.08$	$\pm 3.5$	$\pm 2.0$	$\pm 0.7$
10Itr	-	0.02	0.06	-0.03	-0.02	$\pm 0.07$	$\pm 3.5$	$\pm 2.0$	$\pm 0.7$
Imax	-	-0.25	0.09	-0.05	-0.03	$\pm 0.27$	$\pm 3.5$	$\pm 2.0$	$\pm 0.7$

**Composite Error/MPE (cont.)**

X-Ref. 8.7.6

**Polyphase meter carrying a single-phase load, with balanced voltage applied to the voltage circuits.**

		Intrinsic Error	Temp. Error	Voltage Error	Freq. Error	Comp. Error	Operating Temperature 5°C		
Current	PF Cos. $\phi$	$e(I\cos\phi)$	5°C $e(TI\cos\phi)$	$\pm 10\% U_n$ $e(UI\cos\phi)$	$\pm 2\% f_n$ $e(fI\cos\phi)$	% MPE	Maximum Permissible Error (MPE) Line 1		
							Class A	Class B	Class C
Itr	1.0	0.08	0.11	-0.04	-0.02	$\pm 0.14$	$\pm 4.0$	$\pm 2.5$	$\pm 1.0$
10Itr	-	0.13	0.08	-0.04	-0.03	$\pm 0.16$	$\pm 4.0$	$\pm 2.5$	$\pm 1.0$
Imax	-	0.16	0.10	0.02	-0.01	$\pm 0.19$	$\pm 4.0$	$\pm 2.5$	$\pm 1.0$
Itr	0.5ind	0.09	0.19	-0.06	-0.02	$\pm 0.22$	$\pm 4.0$	$\pm 2.5$	$\pm 1.0$
10Itr	-	0.24	0.08	-0.06	-0.03	$\pm 0.26$	$\pm 4.0$	$\pm 2.5$	$\pm 1.0$
Imax	-	0.20	0.06	-0.04	0.02	$\pm 0.21$	$\pm 4.0$	$\pm 2.5$	$\pm 1.0$

		Intrinsic Error	Temp. Error	Voltage Error	Freq. Error	Comp. Error	Operating Temperature 5°C		
Current	PF Cos. $\phi$	$e(I\cos\phi)$	5°C $e(TI\cos\phi)$	$\pm 10\% U_n$ $e(UI\cos\phi)$	$\pm 2\% f_n$ $e(fI\cos\phi)$	% MPE	Maximum Permissible Error (MPE) Line 2		
							Class A	Class B	Class C
Itr	1.0	0.06	0.10	-0.03	-0.02	$\pm 0.12$	$\pm 4.0$	$\pm 2.5$	$\pm 1.0$
10Itr	-	0.18	0.09	-0.04	-0.02	$\pm 0.21$	$\pm 4.0$	$\pm 2.5$	$\pm 1.0$
Imax	-	0.17	0.08	0.02	0.02	$\pm 0.19$	$\pm 4.0$	$\pm 2.5$	$\pm 1.0$
Itr	0.5ind	-0.07	0.16	-0.04	-0.02	$\pm 0.18$	$\pm 4.0$	$\pm 2.5$	$\pm 1.0$
10Itr	-	0.17	0.14	-0.04	-0.02	$\pm 0.22$	$\pm 4.0$	$\pm 2.5$	$\pm 1.0$
Imax	-	0.09	0.06	-0.07	-0.01	$\pm 0.13$	$\pm 4.0$	$\pm 2.5$	$\pm 1.0$

		Intrinsic Error	Temp. Error	Voltage Error	Freq. Error	Comp. Error	Operating Temperature 5°C		
Current	PF Cos. $\phi$	$e(I\cos\phi)$	5°C $e(TI\cos\phi)$	$\pm 10\% U_n$ $e(UI\cos\phi)$	$\pm 2\% f_n$ $e(fI\cos\phi)$	% MPE	Maximum Permissible Error (MPE) Line 3		
							Class A	Class B	Class C
Itr	1.0	0.12	0.07	-0.02	-0.01	$\pm 0.14$	$\pm 4.0$	$\pm 2.5$	$\pm 1.0$
10Itr	-	0.32	0.06	-0.03	-0.02	$\pm 0.33$	$\pm 4.0$	$\pm 2.5$	$\pm 1.0$
Imax	-	0.25	0.07	-0.04	-0.05	$\pm 0.27$	$\pm 4.0$	$\pm 2.5$	$\pm 1.0$
Itr	0.5ind	-0.16	0.16	0.02	0.01	$\pm 0.23$	$\pm 4.0$	$\pm 2.5$	$\pm 1.0$
10Itr	-	0.28	0.07	-0.05	-0.01	$\pm 0.29$	$\pm 4.0$	$\pm 2.5$	$\pm 1.0$
Imax	-	0.22	0.01	-0.04	-0.09	$\pm 0.24$	$\pm 4.0$	$\pm 2.5$	$\pm 1.0$

**Composite Error/MPE (cont.)**

X-Ref. 8.7.6

		Intrinsic Error	Temp. Error	Voltage Error	Freq. Error	Comp. Error	Operating Temperature 30°C		
Current	PF Cos. $\phi$	$e(I\cos\phi)$	30°C $e(TI\cos\phi)$	$\pm 10\% U_n$ $e(UI\cos\phi)$	$\pm 2\% f_n$ $e(fI\cos\phi)$	% MPE	Maximum Permissible Error (MPE)		
							Class A	Class B	Class C
I <sub>min</sub>	1.0	-0.40	-0.09	-0.08	-0.03	$\pm 0.42$	$\pm 3.5$	$\pm 2.0$	$\pm 1.0$
I <sub>tr</sub>	-	0.02	-0.04	-0.03	-0.02	$\pm 0.06$	$\pm 3.5$	$\pm 2.0$	$\pm 1.0$
10I <sub>tr</sub>	-	0.03	-0.04	-0.04	-0.02	$\pm 0.07$	$\pm 3.5$	$\pm 2.0$	$\pm 1.0$
I <sub>max</sub>	-	-0.08	-0.08	-0.08	-0.03	$\pm 0.14$	$\pm 3.5$	$\pm 2.0$	$\pm 1.0$
I <sub>tr</sub>	0.5ind	0.09	-0.08	-0.04	-0.03	$\pm 0.13$	$\pm 3.5$	$\pm 2.0$	$\pm 0.7$
10I <sub>tr</sub>	-	0.02	-0.05	-0.04	-0.02	$\pm 0.07$	$\pm 3.5$	$\pm 2.0$	$\pm 0.7$
I <sub>max</sub>	-	0.18	-0.06	0.03	0.03	$\pm 0.19$	$\pm 3.5$	$\pm 2.0$	$\pm 0.7$
I <sub>tr</sub>	0.8cap	-0.04	-0.03	-0.03	-0.02	$\pm 0.06$	$\pm 3.5$	$\pm 2.0$	$\pm 0.7$
10I <sub>tr</sub>	-	0.02	-0.03	-0.03	-0.02	$\pm 0.05$	$\pm 3.5$	$\pm 2.0$	$\pm 0.7$
I <sub>max</sub>	-	-0.25	-0.03	-0.05	-0.03	$\pm 0.26$	$\pm 3.5$	$\pm 2.0$	$\pm 0.7$

**Composite Error/MPE (cont.)**

X-Ref. 8.7.6

**Polyphase meter carrying a single-phase load, with balanced voltage applied to the voltage circuits.**

		Intrinsic Error	Temp. Error	Voltage Error	Freq. Error	Comp. Error	Operating Temperature 30°C		
Current	PF Cos. $\phi$	$e(I\cos\phi)$	30°C $e(TI\cos\phi)$	$\pm 10\% U_n$ $e(UI\cos\phi)$	$\pm 2\% f_n$ $e(fI\cos\phi)$	% MPE	Maximum Permissible Error (MPE) Line 1		
							Class A	Class B	Class C
Itr	1.0	0.08	-0.05	-0.04	-0.02	$\pm 0.10$	$\pm 4.0$	$\pm 2.5$	$\pm 1.0$
10Itr	-	0.13	-0.04	-0.04	-0.03	$\pm 0.14$	$\pm 4.0$	$\pm 2.5$	$\pm 1.0$
Imax	-	0.16	-0.02	0.02	-0.01	$\pm 0.16$	$\pm 4.0$	$\pm 2.5$	$\pm 1.0$
Itr	0.5ind	0.09	-0.12	-0.06	-0.02	$\pm 0.16$	$\pm 4.0$	$\pm 2.5$	$\pm 1.0$
10Itr	-	0.24	-0.08	-0.06	-0.03	$\pm 0.26$	$\pm 4.0$	$\pm 2.5$	$\pm 1.0$
Imax	-	0.20	-0.17	-0.04	0.02	$\pm 0.27$	$\pm 4.0$	$\pm 2.5$	$\pm 1.0$

		Intrinsic Error	Temp. Error	Voltage Error	Freq. Error	Comp. Error	Operating Temperature 30°C		
Current	PF Cos. $\phi$	$e(I\cos\phi)$	30°C $e(TI\cos\phi)$	$\pm 10\% U_n$ $e(UI\cos\phi)$	$\pm 2\% f_n$ $e(fI\cos\phi)$	% MPE	Maximum Permissible Error (MPE) Line 2		
							Class A	Class B	Class C
Itr	1.0	0.06	-0.04	-0.03	-0.02	$\pm 0.08$	$\pm 4.0$	$\pm 2.5$	$\pm 1.0$
10Itr	-	0.18	-0.04	-0.04	-0.02	$\pm 0.19$	$\pm 4.0$	$\pm 2.5$	$\pm 1.0$
Imax	-	0.17	-0.03	0.02	0.02	$\pm 0.17$	$\pm 4.0$	$\pm 2.5$	$\pm 1.0$
Itr	0.5ind	-0.07	-0.05	-0.04	-0.02	$\pm 0.10$	$\pm 4.0$	$\pm 2.5$	$\pm 1.0$
10Itr	-	0.17	-0.04	-0.04	-0.02	$\pm 0.18$	$\pm 4.0$	$\pm 2.5$	$\pm 1.0$
Imax	-	0.09	-0.09	-0.07	-0.01	$\pm 0.15$	$\pm 4.0$	$\pm 2.5$	$\pm 1.0$

		Intrinsic Error	Temp. Error	Voltage Error	Freq. Error	Comp. Error	Operating Temperature 30°C		
Current	PF Cos. $\phi$	$e(I\cos\phi)$	30°C $e(TI\cos\phi)$	$\pm 10\% U_n$ $e(UI\cos\phi)$	$\pm 2\% f_n$ $e(fI\cos\phi)$	% MPE	Maximum Permissible Error (MPE) Line 3		
							Class A	Class B	Class C
Itr	1.0	0.12	-0.03	-0.02	-0.01	$\pm 0.13$	$\pm 4.0$	$\pm 2.5$	$\pm 1.0$
10Itr	-	0.32	-0.02	-0.03	-0.02	$\pm 0.32$	$\pm 4.0$	$\pm 2.5$	$\pm 1.0$
Imax	-	0.25	-0.01	-0.04	-0.05	$\pm 0.26$	$\pm 4.0$	$\pm 2.5$	$\pm 1.0$
Itr	0.5ind	-0.16	-0.06	0.02	0.01	$\pm 0.17$	$\pm 4.0$	$\pm 2.5$	$\pm 1.0$
10Itr	-	0.28	-0.05	-0.05	-0.01	$\pm 0.29$	$\pm 4.0$	$\pm 2.5$	$\pm 1.0$
Imax	-	0.22	-0.01	-0.04	-0.09	$\pm 0.24$	$\pm 4.0$	$\pm 2.5$	$\pm 1.0$



**Composite Error/MPE (cont.)**

X-Ref. 8.7.6

		Intrinsic Error	Temp. Error	Voltage Error	Freq. Error	Comp. Error	Operating Temperature 40°C		
Current	PF Cos. $\phi$	$e(I\cos\phi)$	40°C $e(TI\cos\phi)$	$\pm 10\% U_n$ $e(UI\cos\phi)$	$\pm 2\% f_n$ $e(fI\cos\phi)$	% MPE	Maximum Permissible Error (MPE)		
							Class A	Class B	Class C
I <sub>min</sub>	1.0	-0.40	-0.13	-0.08	-0.03	$\pm 0.43$	$\pm 5.0$	$\pm 2.5$	$\pm 1.3$
I <sub>tr</sub>	-	0.02	-0.06	-0.03	-0.02	$\pm 0.07$	$\pm 5.0$	$\pm 2.5$	$\pm 1.3$
10I <sub>tr</sub>	-	0.03	-0.05	-0.04	-0.02	$\pm 0.07$	$\pm 5.0$	$\pm 2.5$	$\pm 1.3$
I <sub>max</sub>	-	-0.08	-0.05	-0.08	-0.03	$\pm 0.13$	$\pm 5.0$	$\pm 2.5$	$\pm 1.3$
I <sub>tr</sub>	0.5ind	0.09	-0.11	-0.04	-0.03	$\pm 0.15$	$\pm 4.5$	$\pm 2.5$	$\pm 1.0$
10I <sub>tr</sub>	-	0.02	-0.06	-0.04	-0.02	$\pm 0.08$	$\pm 4.5$	$\pm 2.5$	$\pm 1.0$
I <sub>max</sub>	-	0.18	-0.03	0.03	0.03	$\pm 0.19$	$\pm 4.5$	$\pm 2.5$	$\pm 1.0$
I <sub>tr</sub>	0.8cap	-0.04	-0.04	-0.03	-0.02	$\pm 0.07$	$\pm 4.5$	$\pm 2.5$	$\pm 1.0$
10I <sub>tr</sub>	-	0.02	-0.03	-0.03	-0.02	$\pm 0.05$	$\pm 4.5$	$\pm 2.5$	$\pm 1.0$
I <sub>max</sub>	-	-0.25	-0.04	-0.05	-0.03	$\pm 0.26$	$\pm 4.5$	$\pm 2.5$	$\pm 1.0$

**Composite Error/MPE (cont.)**

X-Ref. 8.7.6

**Polyphase meter carrying a single-phase load, with balanced voltage applied to the voltage circuits.**

		Intrinsic Error	Temp. Error	Voltage Error	Freq. Error	Comp. Error	Operating Temperature 40°C		
Current	PF Cos. $\phi$	$e(I\cos\phi)$	40°C $e(TI\cos\phi)$	$\pm 10\% U_n$ $e(UI\cos\phi)$	$\pm 2\% f_n$ $e(fI\cos\phi)$	% MPE	Maximum Permissible Error (MPE) Line 1		
							Class A	Class B	Class C
Itr	1.0	0.08	-0.09	-0.04	-0.02	$\pm 0.13$	$\pm 5.0$	$\pm 3.0$	$\pm 1.3$
10Itr	-	0.13	-0.05	-0.04	-0.03	$\pm 0.15$	$\pm 5.0$	$\pm 3.0$	$\pm 1.3$
Imax	-	0.16	-0.05	0.02	-0.01	$\pm 0.17$	$\pm 5.0$	$\pm 3.0$	$\pm 1.3$
Itr	0.5ind	0.09	-0.20	-0.06	-0.02	$\pm 0.23$	$\pm 5.0$	$\pm 3.0$	$\pm 1.3$
10Itr	-	0.24	-0.11	-0.06	-0.03	$\pm 0.27$	$\pm 5.0$	$\pm 3.0$	$\pm 1.3$
Imax	-	0.20	-0.16	-0.04	0.02	$\pm 0.26$	$\pm 5.0$	$\pm 3.0$	$\pm 1.3$

		Intrinsic Error	Temp. Error	Voltage Error	Freq. Error	Comp. Error	Operating Temperature 40°C		
Current	PF Cos. $\phi$	$e(I\cos\phi)$	40°C $e(TI\cos\phi)$	$\pm 10\% U_n$ $e(UI\cos\phi)$	$\pm 2\% f_n$ $e(fI\cos\phi)$	% MPE	Maximum Permissible Error (MPE) Line 2		
							Class A	Class B	Class C
Itr	1.0	0.06	-0.05	-0.03	-0.02	$\pm 0.09$	$\pm 5.0$	$\pm 3.0$	$\pm 1.3$
10Itr	-	0.18	-0.06	-0.04	-0.02	$\pm 0.19$	$\pm 5.0$	$\pm 3.0$	$\pm 1.3$
Imax	-	0.17	-0.05	0.02	0.02	$\pm 0.18$	$\pm 5.0$	$\pm 3.0$	$\pm 1.3$
Itr	0.5ind	-0.07	-0.03	-0.04	-0.02	$\pm 0.09$	$\pm 5.0$	$\pm 3.0$	$\pm 1.3$
10Itr	-	0.17	-0.04	-0.04	-0.02	$\pm 0.18$	$\pm 5.0$	$\pm 3.0$	$\pm 1.3$
Imax	-	0.09	-0.12	-0.07	-0.01	$\pm 0.17$	$\pm 5.0$	$\pm 3.0$	$\pm 1.3$

		Intrinsic Error	Temp. Error	Voltage Error	Freq. Error	Comp. Error	Operating Temperature 40°C		
Current	PF Cos. $\phi$	$e(I\cos\phi)$	40°C $e(TI\cos\phi)$	$\pm 10\% U_n$ $e(UI\cos\phi)$	$\pm 2\% f_n$ $e(fI\cos\phi)$	% MPE	Maximum Permissible Error (MPE) Line 3		
							Class A	Class B	Class C
Itr	1.0	0.12	-0.02	-0.02	-0.01	$\pm 0.12$	$\pm 5.0$	$\pm 3.0$	$\pm 1.3$
10Itr	-	0.32	-0.02	-0.03	-0.02	$\pm 0.32$	$\pm 5.0$	$\pm 3.0$	$\pm 1.3$
Imax	-	0.25	-0.02	-0.04	-0.05	$\pm 0.26$	$\pm 5.0$	$\pm 3.0$	$\pm 1.3$
Itr	0.5ind	-0.16	-0.10	0.02	0.01	$\pm 0.19$	$\pm 5.0$	$\pm 3.0$	$\pm 1.3$
10Itr	-	0.28	-0.05	-0.05	-0.01	$\pm 0.29$	$\pm 5.0$	$\pm 3.0$	$\pm 1.3$
Imax	-	0.22	0.01	-0.04	-0.09	$\pm 0.24$	$\pm 5.0$	$\pm 3.0$	$\pm 1.3$

**Composite Error/MPE (cont.)**

X-Ref. 8.7.6

		Intrinsic Error	Temp. Error	Voltage Error	Freq. Error	Comp. Error	Operating Temperature 55°C		
Current	PF Cos. $\phi$	$e(I\cos\phi)$	55°C $e(TI\cos\phi)$	$\pm 10\% U_n$ $e(UI\cos\phi)$	$\pm 2\% f_n$ $e(fI\cos\phi)$	% MPE	Maximum Permissible Error (MPE)		
							Class A	Class B	Class C
I <sub>min</sub>	1.0	-0.40	-0.18	-0.08	-0.03	$\pm 0.45$	$\pm 7.0$	$\pm 3.5$	$\pm 1.7$
I <sub>tr</sub>	-	0.02	-0.04	-0.03	-0.02	$\pm 0.06$	$\pm 7.0$	$\pm 3.5$	$\pm 1.7$
10I <sub>tr</sub>	-	0.03	-0.02	-0.04	-0.02	$\pm 0.06$	$\pm 7.0$	$\pm 3.5$	$\pm 1.7$
I <sub>max</sub>	-	-0.08	-0.04	-0.08	-0.03	$\pm 0.12$	$\pm 7.0$	$\pm 3.5$	$\pm 1.7$
I <sub>tr</sub>	0.5ind	0.09	-0.11	-0.04	-0.03	$\pm 0.15$	$\pm 7.0$	$\pm 3.5$	$\pm 1.3$
10I <sub>tr</sub>	-	0.02	-0.04	-0.04	-0.02	$\pm 0.06$	$\pm 7.0$	$\pm 3.5$	$\pm 1.3$
I <sub>max</sub>	-	0.18	-0.01	0.03	0.03	$\pm 0.19$	$\pm 7.0$	$\pm 3.5$	$\pm 1.3$
I <sub>tr</sub>	0.8cap	-0.04	-0.03	-0.03	-0.02	$\pm 0.06$	$\pm 7.0$	$\pm 3.5$	$\pm 1.3$
10I <sub>tr</sub>	-	0.02	-0.01	-0.03	-0.02	$\pm 0.04$	$\pm 7.0$	$\pm 3.5$	$\pm 1.3$
I <sub>max</sub>	-	-0.25	-0.01	-0.05	-0.03	$\pm 0.26$	$\pm 7.0$	$\pm 3.5$	$\pm 1.3$

**Composite Error/MPE (cont.)**

X-Ref. 8.7.6

**Polyphase meter carrying a single-phase load, with balanced voltage applied to the voltage circuits.**

		Intrinsic Error	Temp. Error	Voltage Error	Freq. Error	Comp. Error	Operating Temperature 55°C		
Current	PF Cos. $\phi$	$e(I\cos\phi)$	55°C $e(TI\cos\phi)$	$\pm 10\% U_n$ $e(UI\cos\phi)$	$\pm 2\% f_n$ $e(fI\cos\phi)$	% MPE	Maximum Permissible Error (MPE) Line 1		
							Class A	Class B	Class C
Itr	1.0	0.08	-0.10	-0.04	-0.02	$\pm 0.14$	$\pm 7.0$	$\pm 4.0$	$\pm 1.7$
10Itr	-	0.13	-0.04	-0.04	-0.03	$\pm 0.14$	$\pm 7.0$	$\pm 4.0$	$\pm 1.7$
Imax	-	0.16	-0.06	0.02	-0.01	$\pm 0.17$	$\pm 7.0$	$\pm 4.0$	$\pm 1.7$
Itr	0.5ind	0.09	-0.28	-0.06	-0.02	$\pm 0.30$	$\pm 7.0$	$\pm 4.0$	$\pm 1.7$
10Itr	-	0.24	-0.13	-0.06	-0.03	$\pm 0.28$	$\pm 7.0$	$\pm 4.0$	$\pm 1.7$
Imax	-	0.20	-0.14	-0.04	0.02	$\pm 0.25$	$\pm 7.0$	$\pm 4.0$	$\pm 1.7$

		Intrinsic Error	Temp. Error	Voltage Error	Freq. Error	Comp. Error	Operating Temperature 55°C		
Current	PF Cos. $\phi$	$e(I\cos\phi)$	55°C $e(TI\cos\phi)$	$\pm 10\% U_n$ $e(UI\cos\phi)$	$\pm 2\% f_n$ $e(fI\cos\phi)$	% MPE	Maximum Permissible Error (MPE) Line 2		
							Class A	Class B	Class C
Itr	1.0	0.06	0.18	-0.03	-0.02	$\pm 0.19$	$\pm 7.0$	$\pm 4.0$	$\pm 1.7$
10Itr	-	0.18	-0.01	-0.04	-0.02	$\pm 0.19$	$\pm 7.0$	$\pm 4.0$	$\pm 1.7$
Imax	-	0.17	-0.01	0.02	0.02	$\pm 0.17$	$\pm 7.0$	$\pm 4.0$	$\pm 1.7$
Itr	0.5ind	-0.07	0.17	-0.04	-0.02	$\pm 0.19$	$\pm 7.0$	$\pm 4.0$	$\pm 1.7$
10Itr	-	0.17	0.14	-0.04	-0.02	$\pm 0.22$	$\pm 7.0$	$\pm 4.0$	$\pm 1.7$
Imax	-	0.09	0.02	-0.07	-0.01	$\pm 0.12$	$\pm 7.0$	$\pm 4.0$	$\pm 1.7$

		Intrinsic Error	Temp. Error	Voltage Error	Freq. Error	Comp. Error	Operating Temperature 55°C		
Current	PF Cos. $\phi$	$e(I\cos\phi)$	55°C $e(TI\cos\phi)$	$\pm 10\% U_n$ $e(UI\cos\phi)$	$\pm 2\% f_n$ $e(fI\cos\phi)$	% MPE	Maximum Permissible Error (MPE) Line 3		
							Class A	Class B	Class C
Itr	1.0	0.12	-0.04	-0.02	-0.01	$\pm 0.13$	$\pm 7.0$	$\pm 4.0$	$\pm 1.7$
10Itr	-	0.32	-0.05	-0.03	-0.02	$\pm 0.33$	$\pm 7.0$	$\pm 4.0$	$\pm 1.7$
Imax	-	0.25	-0.04	-0.04	-0.05	$\pm 0.26$	$\pm 7.0$	$\pm 4.0$	$\pm 1.7$
Itr	0.5ind	-0.16	0.06	0.02	0.01	$\pm 0.17$	$\pm 7.0$	$\pm 4.0$	$\pm 1.7$
10Itr	-	0.28	0.02	-0.05	-0.01	$\pm 0.29$	$\pm 7.0$	$\pm 4.0$	$\pm 1.7$
Imax	-	0.22	-0.07	-0.04	-0.09	$\pm 0.25$	$\pm 7.0$	$\pm 4.0$	$\pm 1.7$

**Composite Error/MPE (cont.)**

X-Ref. 8.7.6

		Intrinsic Error	Temp. Error	Voltage Error	Freq. Error	Comp. Error	Operating Temperature 70°C		
Current	PF Cos. $\phi$	$e(I\cos\phi)$	70°C $e(TI\cos\phi)$	$\pm 10\% U_n$ $e(UI\cos\phi)$	$\pm 2\% f_n$ $e(fI\cos\phi)$	% MPE	Maximum Permissible Error (MPE)		
							Class A	Class B	Class C
I <sub>min</sub>	1.0	-0.40	-0.26	-0.08	-0.03	$\pm 0.48$	$\pm 9.0$	$\pm 4.0$	$\pm 2.0$
I <sub>tr</sub>	-	0.02	0.00	-0.03	-0.02	$\pm 0.04$	$\pm 9.0$	$\pm 4.0$	$\pm 2.0$
10I <sub>tr</sub>	-	0.03	0.04	-0.04	-0.02	$\pm 0.07$	$\pm 9.0$	$\pm 4.0$	$\pm 2.0$
I <sub>max</sub>	-	-0.08	0.01	-0.08	-0.03	$\pm 0.12$	$\pm 9.0$	$\pm 4.0$	$\pm 2.0$
I <sub>tr</sub>	0.5ind	0.09	-0.05	-0.04	-0.03	$\pm 0.11$	$\pm 9.0$	$\pm 4.0$	$\pm 1.5$
10I <sub>tr</sub>	-	0.02	0.03	-0.04	-0.02	$\pm 0.06$	$\pm 9.0$	$\pm 4.0$	$\pm 1.5$
I <sub>max</sub>	-	0.18	0.11	0.03	0.03	$\pm 0.22$	$\pm 9.0$	$\pm 4.0$	$\pm 1.5$
I <sub>tr</sub>	0.8cap	-0.04	0.00	-0.03	-0.02	$\pm 0.05$	$\pm 9.0$	$\pm 4.0$	$\pm 1.5$
10I <sub>tr</sub>	-	0.02	0.04	-0.03	-0.02	$\pm 0.06$	$\pm 9.0$	$\pm 4.0$	$\pm 1.5$
I <sub>max</sub>	-	-0.25	0.01	-0.05	-0.03	$\pm 0.26$	$\pm 9.0$	$\pm 4.0$	$\pm 1.5$

**Composite Error/MPE (cont.)**

X-Ref. 8.7.6

**Polyphase meter carrying a single-phase load, with balanced voltage applied to the voltage circuits.**

		Intrinsic Error	Temp. Error	Voltage Error	Freq. Error	Comp. Error	Operating Temperature 70°C		
Current	PF Cos. $\phi$	$e(I\cos\phi)$	70°C $e(TI\cos\phi)$	$\pm 10\% U_n$ $e(UI\cos\phi)$	$\pm 2\% f_n$ $e(fI\cos\phi)$	% MPE	Maximum Permissible Error (MPE) Line 1		
							Class A	Class B	Class C
Itr	1.0	0.08	-0.09	-0.04	-0.02	$\pm 0.13$	$\pm 9.0$	$\pm 4.5$	$\pm 2.0$
10Itr	-	0.13	0.00	-0.04	-0.03	$\pm 0.14$	$\pm 9.0$	$\pm 4.5$	$\pm 2.0$
Imax	-	0.16	0.00	0.02	-0.01	$\pm 0.16$	$\pm 9.0$	$\pm 4.5$	$\pm 2.0$
Itr	0.5ind	0.09	-0.31	-0.06	-0.02	$\pm 0.33$	$\pm 9.0$	$\pm 4.5$	$\pm 2.0$
10Itr	-	0.24	-0.08	-0.06	-0.03	$\pm 0.26$	$\pm 9.0$	$\pm 4.5$	$\pm 2.0$
Imax	-	0.20	-0.05	-0.04	0.02	$\pm 0.21$	$\pm 9.0$	$\pm 4.5$	$\pm 2.0$

		Intrinsic Error	Temp. Error	Voltage Error	Freq. Error	Comp. Error	Operating Temperature 70°C		
Current	PF Cos. $\phi$	$e(I\cos\phi)$	70°C $e(TI\cos\phi)$	$\pm 10\% U_n$ $e(UI\cos\phi)$	$\pm 2\% f_n$ $e(fI\cos\phi)$	% MPE	Maximum Permissible Error (MPE) Line 2		
							Class A	Class B	Class C
Itr	1.0	0.06	0.01	-0.03	-0.02	$\pm 0.07$	$\pm 9.0$	$\pm 4.5$	$\pm 2.0$
10Itr	-	0.18	0.00	-0.04	-0.02	$\pm 0.19$	$\pm 9.0$	$\pm 4.5$	$\pm 2.0$
Imax	-	0.17	0.01	0.02	0.02	$\pm 0.17$	$\pm 9.0$	$\pm 4.5$	$\pm 2.0$
Itr	0.5ind	-0.07	0.19	-0.04	-0.02	$\pm 0.21$	$\pm 9.0$	$\pm 4.5$	$\pm 2.0$
10Itr	-	0.17	0.12	-0.04	-0.02	$\pm 0.21$	$\pm 9.0$	$\pm 4.5$	$\pm 2.0$
Imax	-	0.09	0.01	-0.07	-0.01	$\pm 0.11$	$\pm 9.0$	$\pm 4.5$	$\pm 2.0$

		Intrinsic Error	Temp. Error	Voltage Error	Freq. Error	Comp. Error	Operating Temperature 70°C		
Current	PF Cos. $\phi$	$e(I\cos\phi)$	70°C $e(TI\cos\phi)$	$\pm 10\% U_n$ $e(UI\cos\phi)$	$\pm 2\% f_n$ $e(fI\cos\phi)$	% MPE	Maximum Permissible Error (MPE) Line 3		
							Class A	Class B	Class C
Itr	1.0	0.12	0.08	-0.02	-0.01	$\pm 0.15$	$\pm 9.0$	$\pm 4.5$	$\pm 2.0$
10Itr	-	0.32	0.10	-0.03	-0.02	$\pm 0.34$	$\pm 9.0$	$\pm 4.5$	$\pm 2.0$
Imax	-	0.25	0.07	-0.04	-0.05	$\pm 0.27$	$\pm 9.0$	$\pm 4.5$	$\pm 2.0$
Itr	0.5ind	-0.16	-0.05	0.02	0.01	$\pm 0.17$	$\pm 9.0$	$\pm 4.5$	$\pm 2.0$
10Itr	-	0.28	0.02	-0.05	-0.01	$\pm 0.29$	$\pm 9.0$	$\pm 4.5$	$\pm 2.0$
Imax	-	0.22	0.15	-0.04	-0.09	$\pm 0.28$	$\pm 9.0$	$\pm 4.5$	$\pm 2.0$



### 3 VARIATION OF ERROR DUE TO DISTURBANCES OF LONG DURATION

EN50470-3 X-Ref. 8.7.7

#### 3.1 Severe Voltage Variation

X-Ref. 8.7.7.2

Sample No: M12

Test Procedure: EN50470-3 Severe Voltage Variation

Test Conditions:  $U_n: 3x230/400V$   $I_{ref}: 10A$   $F_n: 50Hz$

Test Circuit: *3 phase 4 wire*

Measurement Mode: *Active Import Energy kWh*

		80% $U_n$	115% $U_n$	Critical Change % Error Limit		
Current	PF Cos. $\phi$	% Error	% Error	Accuracy		
10Itr (Iref)	1.0	-0.03	0.02	Class A $\pm 3.0$	Class B $\pm 2.1$	Class C $\pm 0.6$
10Itr (Iref)	0.5ind	-0.02	0.05	$\pm 4.5$	$\pm 3.0$	$\pm 1.2$

		< 80% $U_n$	Critical Change % Error Limit		
Current	PF Cos. $\phi$	% Error	Accuracy		
10Itr (Iref)	1.0	$20\%U_n$ -0.11	Class A +10 to -100	Class B +10 to -100	Class C +10 to -100
10Itr (Iref)	0.5ind	-0.15	+10 to -100	+10 to -100	+10 to -100



### 3.2 Reversed Phase Sequence

X-Ref. 8.7.7.3

Sample No: M12

Test Procedure: EN50470-3 Severe Voltage Variation

Test Conditions:  $U_n: 3 \times 230/400V$   $I_{tr}: 1A$   $F_n: 50Hz$

Test Circuit: *3 phase 4 wire*

Measurement Mode: *Active Import Energy kWh*

Current	Phase Sequence	% Error	Critical Change % Error Limit		
			Accuracy		
			Class A	Class B	Class C
Itr	L1-L2-L3	0.01	-	-	-
Itr	L1-L3-L2	0.10	±1.5	±1.5	±0.3



### 3.3 Voltage Unbalance

X-Ref. 8.7.7.4

Sample No: M12	Test Procedure: EN50470-3 Phase Interruption
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Test Conditions:  $U_n: 3 \times 230/400V$   $I_{ref}: 10A$   $F_n: 50Hz$

Test Circuit: *3 phase 4 wire*

Measurement Mode: *Active Import Energy kWh*

Current	Network Phase/ Lines Connected	% Error	Critical Change % Error Limit		
			Accuracy		
			Class A	Class B	Class C
Iref/ In	L1 &L2 & L3	0.02	-	-	-
Iref/ In	L2 & L3	0.02	±4.0	±2.0	±1.0
Iref/ In	L1 & L3	0.00	±4.0	±2.0	±1.0
Iref/ In	L1 & L2	0.04	±4.0	±2.0	±1.0
Iref/ In	L3	-0.02	±4.0	±2.0	±1.0
Iref/ In	L2	0.03	±4.0	±2.0	±1.0
Iref/ In	L1	0.01	±4.0	±2.0	±1.0

### 3.4 Short-time Over Current

X-Ref. 8.7.8

Sample No: M2	Test Procedure: EN50470-3 Short-Time Over-Current
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#### Environmental Conditions

Temperature	22.3°C
Relative Humidity	52.3%
Barometric Pressure	998mB

The test was applied under the following conditions:

Meter for direct connection:

Impulse current applied: 30.Imax for one half cycle at rated frequency = 10ms

The test was applied under the following conditions:

Meter for connection through current transformer:

Impulse current applied: 20.Imax for 0.5seconds

On completion of the above test, the meters voltage circuits were energised at reference voltage for 1 hour after which the meter was found to function correctly and within the accuracy specification when subsequently operated under reference operating conditions.

Test Conditions:  $Un: 3x230/400V$   $10Itr: 10A$   $Fn: 50Hz$

Test Circuit:  $3\ phase\ 4\ wire$

Current	PF Cos. $\phi$	% Error	Critical Change % Error Limit		
			Accuracy		
			Class A	Class B	Class C
10Itr	1.0	0.01	±1.5	±1.5	±1.5

### 3.5 Influence of Self Heating

X-Ref. 8.7.7.5

The meter voltage circuits were energised at reference voltage for at least 1 hour (class A), 2 hours(class B & C), without any current in the current circuits, after which the meter's maximum rated current was applied and the meter error determined every 5 minutes.

The test was conducted at power factors of both  $\text{Cos. } \phi = 1.0$  and  $\text{Cos. } \phi = 0.5 \text{ ind.}$

Sample No: M12	Test Procedure: EN50470-3 (Class B) Self Heating
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Test Conditions:  $Un: 3x230/400V$   $Fn: 50Hz$   
 $Imax: 80A$   $PF: \text{Cos. } \phi = 1.0, \text{Cos. } \phi = 0.5L$

Test Circuit: *3 phase 4 wire*

Measurement Mode: *Active Energy kWh*

Elapsed Test time (minutes)	Un Im Cos. $\phi = 1.0$	Un Im Cos. $\phi = 0.5L$
	<i>% Error</i>	<i>% Error</i>
1	-0.11	0.10
5	-0.14	0.15
10	-0.10	0.10
15	-0.09	0.15
20	-0.11	0.15
25	-0.13	0.15
30	-0.07	0.14
35	-0.10	0.15
40	-0.13	0.13
45	-0.09	0.15
50	-0.09	0.17
55	-0.11	0.16
60	-0.09	0.13

Critical Change of % Error Limit:

Class C  $\pm 0.2\%$  @  $\text{Cos. } \phi = 1.0$  &  $\pm 0.2\%$  @  $\text{Cos. } \phi = 0.5 \text{ ind}$

Class B  $\pm 0.7\%$  @  $\text{Cos. } \phi = 1.0$  &  $\pm 1.0\%$  @  $\text{Cos. } \phi = 0.5 \text{ ind}$

Class A  $\pm 1.0\%$  @  $\text{Cos. } \phi = 1.0$  &  $\pm 1.5\%$  @  $\text{Cos. } \phi = 0.5 \text{ ind}$

### 3.6 Harmonic Components in the Current and Voltage Circuits

X-Ref. 8.7.7.7

Sample No: 11809192840016	Test Procedure: EN50470-3 Harmonics Tests
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Test Conditions:  $U_n: 3x230/400V$   $F_n: 50Hz$   $PF: Cos. \phi = 1.0$   
 $I_{ref}: 10A$   $I_{max}: 80A$

Fundamental Frequency Current:  $I_0 = 0.5 I_{max}$   
 Fundamental frequency Voltage:  $U_0 = U_n$   
 Content of 5<sup>th</sup> Harmonic Current:  $I_5 = 40\%$  of  $I_0$   
 Content of 5<sup>th</sup> Harmonic Voltage:  $U_5 = 10\%$  of  $U_n$

Resulting harmonic power due to the 5<sup>th</sup> harmonic presence:  $P_{resultant} = 1.04 P_0$

Test Circuit: *3 phase 4 wire*

Measurement Mode: *Active Energy kWh*

Waveform	% Error	Critical Change % Error Limit		
		Accuracy		
		Class A	Class B	Class C
Fundamental Only ( $P_0$ ) 0.5 $I_{max}$	-	-	-	-
Fundamental + 5 <sup>th</sup> Harmonic ( $P_{resultant} = 1.04 P_0$ )	-0.08	±1.0	±0.8	±0.5

### 3.7 Influence of Odd and Sub Harmonics in the AC Current Circuit

X-Ref. 8.7.7.9

Sample No: 11809192840016	Test Procedure: EN50470-3 Harmonics Tests
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Test Conditions:  $U_n: 3x230/400V$   $F_n: 50Hz$   $PF: Cos. \phi = 1.0$   
 $5I_{tr}: 5A$

Reference Current Waveform:  $I_{ref} = 5I_{tr}$   
 Reference Voltage:  $U = U_n$   
 Test Current Phase-Fired Waveform:  $I_{test} = \sqrt{2} \cdot I_{ref}$   
 Firing Points:  $5ms$  and  $15ms \pm 1ms$   
 Test Current Burst fired Waveform:  $I_{test} = 2 \cdot I_{ref}$   
 Distortion Factor on the Voltage Waveform:  $< 0.5 \% THD$

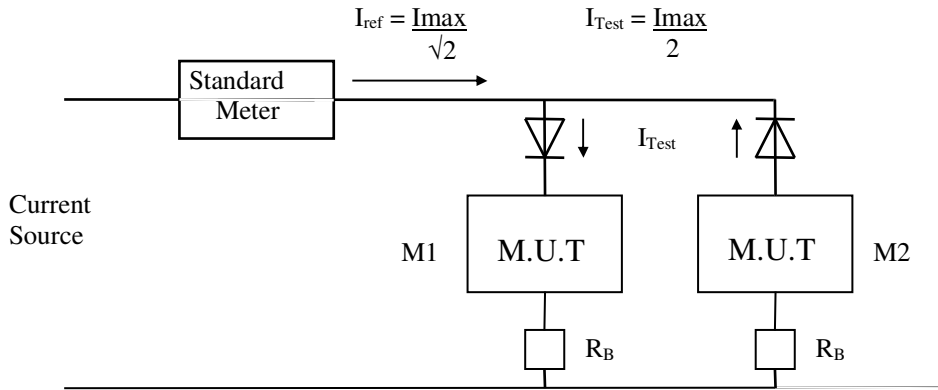
Test Circuit: *3 phase 4 wire*

Measurement Mode: *Active Energy kWh*

Waveform	% Error	Critical Change % Error Limit		
		Accuracy		
		Class A	Class B	Class C
Fundamental Only $5I_{tr}$	-	-	-	-
Waveform Phase-fired Test current	<i>0.01</i>	$\pm 6.0$	$\pm 3.0$	$\pm 1.5$
Waveform Burst fired Test current	<i>-0.08</i>	$\pm 6.0$	$\pm 3.0$	$\pm 1.5$

### 3.8 Influence of DC and Even Harmonics in the AC Current Circuit X-Ref. 8.7.7.8

Tests were conducted with the M.U.T connect in each of the circuit limbs M1 & M2 in turn, the overall error of the meter being the mean of the two errors obtained.



Sample No: 11809192840016 Test Procedure: EN50470-3 Harmonics Tests

Test Conditions:      *Un: 3x230/400V      Fn: 50Hz*  
                                  *I<sub>max</sub>: 80A      PF: Cos. ϕ = 1.0*

Test Circuit:            *1 phase 2 wire. In the case of Polyphase meter's tests were conducted on element L1 only.*

A.C current: 0.707I<sub>max</sub> - fundamental waveform (I<sub>ref</sub>)  
 Equivalent half wave DC current: 0.5 I<sub>max</sub>. (I<sub>Test</sub>)

Test Current	% Error	Critical Change % Error Limit		
		Accuracy		
		Class A	Class B	Class C
0.707I <sub>max</sub> (I <sub>ref</sub> )	-0.82	-	-	-
0.5I <sub>max</sub> (I <sub>test</sub> )	-0.86	±6.0	±3.0	±1.5

**4 ELECTRICAL REQUIREMENTS**

EN50470-1 X-Ref. 7

**4.1 Power Consumption**

EN50470-3 X-Ref. 7.1

Sample No: M2	Test Procedure: EN50470-3 Power Consumption
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**Environmental Conditions**

Temperature	22.4°C
Relative Humidity	57.3%
Barometric Pressure	998mB

	Volts/V	Amps/A	VA	Watts/W
<u>Wiring Configuration:</u> <u>Three Phase Four Wire</u>				
Voltage Circuit: <b>L1</b>	230	0.07	1.53	0.32
Voltage Circuit: <b>L2</b>	230	0.06	1.49	0.35
Voltage Circuit: <b>L3</b>	230	0.07	1.55	0.35
Current Circuit: <b>L1</b>	0.002	10	0.02	---
Current Circuit: <b>L2</b>	0.002	10	0.02	---
Current Circuit: <b>L3</b>	0.002	10	0.02	---

Power consumption limits shall not exceed the following based on IEC 62053-61: 1998-02

<u>Voltage Circuits</u>	<u>Single Phase</u>		<u>Two Element</u>		<u>Three Element</u>	
Basic Meter	2W	10VA	2W	10VA	2W	10VA
Multi-Energy Meter	3W	15VA	2.5W	12.5VA	2W	10VA
Multi-Function Meter	5W	25VA	3.5W	17.5VA	3W	15VA

Current Circuits

Direct connected      2.5VA for Class A  
    4.0VA for Class B & Class C

CT connected            1.0VA for Class A, B & C

## 4.2 Test of Influence of Heating

EN50470-1 X-Ref. 7.2

Sample No: M2

Test Procedure: EN50470-3 Heating

Test Conditions:  $115\%U_n: 264.5V$   $I_{max}: 80A$   $F_n: 50Hz$

Ambient Temperature :  $40^{\circ}C$   
Test Duration : 2 hours  
Surface Temperature Rise : 15.0K

Permissible temperature rise: 25K

Surface temperature of the meter was measured on the meter back, approximately 10mm above the meter terminal block.

On completion of the above tests, the meters were found to function correctly and within the accuracy specification when subsequently operated under reference operating conditions, with no signs of damage or degradation in the meter's insulation properties.



**5 ELECTROMAGNETIC COMPATIBILITY (E.M.C.) EN50470-1 X-Ref. 7.4**

**5.1 Immunity to Voltage Dips and Interruptions X-Ref. 7.4.4**

Sample No: 11809192840016	Test Procedure: EN50470-3 Voltage Dips
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**Environmental Conditions**

Power Supply	230V, 50Hz
Temperature	21.5°C
Relative Humidity	56%
Barometric Pressure	998mB

Test Circuit: *3 phase 4 wire, in the case of Polyphase meters tests were conducted on each voltage circuit in turn.*

The tests were applied under the following conditions;

- voltage and auxiliary circuits energised with reference voltage
- current circuits open.

Test a)	Voltage interruption of :	V = 100%
	Interruption time :	1s
	Number of interruptions :	3
	Restoring time between interruption :	50ms
Test b)	Voltage interruption of :	V = 100%
	Interruption time:	20ms
	Number of interruptions:	1
Test c)	Voltage depression of :	V=50%
	Depression time:	60s
	Number of depressions:	1

The application of the above tests did not produce a change in the meter registers of more than  $x$  kWh, and the test output did not produce a signal equivalent of more than  $x$  kWh, where  $x$  is given by

$$x = 10^{-6} \cdot m \cdot Un \cdot I_{max}$$

Sample No: 11809192840016	Test Procedure: EN50470-3 Electrostatic Discharge
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The meter was tested in accordance with IEC 61000-4-2 as follows:

**Environmental Conditions**

Power Supply	230V, 50Hz
Temperature	21.5°C
Relative Humidity	56%
Barometric Pressure	998mB

**E.S.D Generator specification:**

- Test level severities:** 8kV contact, conductive surfaces / coupling planes  
15kV air gap discharge - non conducting surfaces
- Polarity:** Positive and negative
- Number of discharges:** 10 at each polarity
- Rise time of discharge current:** <1ns
- Pulse duration (50%):** 30ns
- Time between discharges:** 1s

Meter in operating condition with the voltage and auxiliary circuits energised. Current circuits open.

The application of the electrostatic discharge did not produce a change in the meter registers of more than  $x$  kWh, and the test output did not produce a signal equivalent of more than  $x$  kWh, where  $x$  is given by

$$x = 10^{-6} \cdot m \cdot U_n \cdot I_{max}$$

On completion of the above tests, the meter was found to function correctly and within the accuracy specification when subsequently operated under reference operating conditions.

### 5.3 Immunity to Electromagnetic RF Fields

EN50470-1 X-Ref. 7.4.6  
 EN50470-3 X-Ref. 8.7.7.12

Sample No: 11809192840016	Test Procedure: EN50470-1 Radiated Immunity
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The meter was tested in accordance with IEC 61000-4-3 in the SGS Anechoic chamber as follows:

#### Environmental Conditions

Temperature	21.5°C
Relative Humidity	56%
Barometric Pressure	998mB

**Port:** Enclosure  
**Test Level:** 10 V/m (test 1) & 30 V/m (test 2)  
**Frequency Range:** 80-2000 MHz  
**Dwell Time:** 2 Seconds  
**Frequency Step Size:** 1%  
**Modulation:** 80%, 1 kHz Amplitude Modulation.

#### Operating Mode:

Test 1) Voltage and auxiliary circuits energised with reference voltage, current (10Itr) in the current circuits, Cos.  $\phi = 1$ .

Test 2) Voltage and auxiliary circuits energised with reference voltage, without any current in the current circuits. Current circuits open circuit.

#### Test Results (80-2000MHz)

EUT Face	Polarity	Test 1 Maximum % Error Observed	Test 2	Critical Change % Error Limit	
				Accuracy	
				Class 0.5	Class 0.2
Front	Horizontal	0.28	Note 1	±2.0	±1.0
Front	Vertical	0.29	Note 1	±2.0	±1.0
Rear	Horizontal	0.29	Note 1	±2.0	±1.0
Rear	Vertical	0.30	Note 1	±2.0	±1.0
LHS	Horizontal	0.29	Note 1	±2.0	±1.0
LHS	Vertical	0.27	Note 1	±2.0	±1.0
RHS	Horizontal	0.27	Note 1	±2.0	±1.0
RHS	Vertical	0.27	Note 1	±2.0	±1.0

**Note 1:** No change of register information and no signal outputs observed.



## 5.4 Immunity to Electrical Fast Transients

EN50470-1 X-Ref. 7.4.7  
EN50470-3 X-Ref. 8.7.7.14

Sample No: 11809192840016

Test Procedure: EN50470-1 Fast Transient Bursts

The meter was tested in accordance with IEC 61000-4-4 as follows:

### Environmental Conditions

Temperature	21.5°C
Relative Humidity	56%
Barometric Pressure	998mB

### Transient/Burst specification:

<b>Pulse level severity:</b>	4kV – current and voltage circuits 2kV – auxiliary circuits
<b>Rise time:</b>	5ns
<b>Width:</b>	50ns
<b>Repetition Rate:</b>	5 kHz
<b>Burst Duration:</b>	15ms
<b>Burst Period:</b>	300ms
<b>Burst Generation:</b>	Asynchronous (Common mode)

### Operating mode:

The meter voltage circuits were energised at reference voltage  $U_n$ , with  $10I_{tr} \cos. \phi = 1.0$  in the current circuits.

Test voltage severity level  $\pm 4kV$ , Repetition Rate 5kHz voltage and current circuits  
Test voltage severity level  $\pm 2kV$ , Repetition Rate 5kHz auxiliary circuits  $> 40V$

The test voltage was applied on the current and voltage circuits in common mode, for a test duration of 60 seconds at each polarity.



## Immunity to Electrical Fast Transients (cont.)

### Test Results

Test Voltage (kV)	% Error	Critical Change % Error Limit		
		Accuracy		
		Class A	Class B	Class C
No FTB applied	-	-	-	-
±4 (Voltage & Current Circuits)	-0.19	±6.0	±4.0	±2.0
±2 (Auxiliary Circuits of > 40V)	-	±6.0	±4.0	±2.0

On completion of the above test, the meter was found to function correctly and within the accuracy specification when subsequently operated under reference operating conditions, with no signs of damage or corruption to meter register data.

## 5.5 Immunity to Conducted Disturbances

EN50470-1 X-Ref. 7.4.8  
 EN50470-3 X-Ref. 8.7.7.15

Sample No: 11809192840016	Test Procedure: EN50470-1 Conducted Immunity
---------------------------	--

The meter was tested in accordance with IEC 61000-4-6 as follows:

### Environmental Conditions

Temperature	21.5°C
Relative Humidity	56%
Barometric Pressure	998mB

**Ports:** Current, Voltage and Auxiliary Circuits  
**Test Level:** 10 V  
**Frequency Range:** 0.15 to 80 MHz  
**Dwell Time:** 2 Secs  
**Frequency Step Size:** 1%  
**Modulation:** 80%, 1kHz Amplitude Modulation.

### Operating Mode:

Voltage and auxiliary circuits energised with reference voltage and with 10Itr applied

### Test Results:

MUT Port	Frequency Range (MHz)	Maximum % Error Observed	Critical Change % Error Limit Accuracy		
			Class A	Class B	Class C
Voltage & Current Circuits	0.15 to 80	0.17	±3.0	±2.0	±1.0

Sample No: 11809192840016	Test Procedure: EN50470-1 Surge
---------------------------	---------------------------------

The meter was tested in accordance with IEC 61000-4-5 as follows:

**Environmental Conditions**

Temperature	21.5°C
Relative Humidity	56%
Barometric Pressure	998mB

<b>Ports:</b>	Voltage and Auxiliary Circuits
<b>Test Voltage:</b>	4kV mains, 1kV auxiliary
<b>Test Mode:</b>	Differential (line to line)
<b>Phase Angle:</b>	60° and 240° relative to zero crossing
<b>Number of Tests:</b>	5 positive and 5 negative
<b>Repetition Rate:</b>	1/min

**Operating mode:**

The meter voltage circuits were energised at reference voltage  $U_n$ , without any current in the current circuits

The application of the surge immunity test voltage did not produce a change in the meter registers of more than  $x$  kWh and the test output did not produce a signal equivalent of more than  $x$  kWh, where  $x$  is given by

$$x = 10^{-6} \cdot m \cdot U_n \cdot I_{max}$$



## 5.7 Radio Interference Measurement

EN50470-1 X-Ref. 7.4.13

### Radiated Emissions

Sample No: 11809192840045

Test Procedure: EN50470-1 Radiated Emissions

The meter was tested in accordance with EN55022 as follows:

#### Environmental Conditions

Power Supply	230V, 50Hz
Temperature	21.5°C
Relative Humidity	56%
Barometric Pressure	998mB

The MUT compliance measurements were performed in the SGS Semi-Anechoic chamber (which is in compliance with the site attenuation requirements of EN55016-1-4:2007, A1:2008).

The measurement distance was 3m and the limit has been adjusted using inverse proportionality factor of 20dB per decade.

#### Operating Mode

The MUT was operated with voltage and auxiliary circuits energised with reference voltage and a current of between  $0.1I_{ref}$  and  $0.2I_{ref}$  and 1m leads attached to all terminals.



**Radiated Emissions (cont.)**

**Results: Results: Pass**

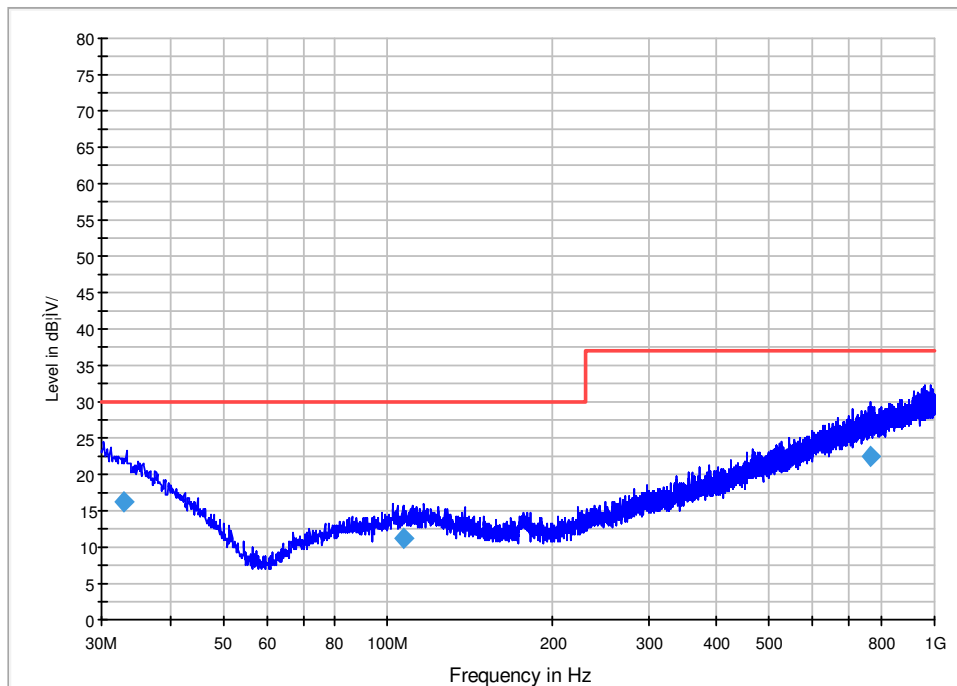
Limit value of Class B equipments

Frequency/MHz	Test distance 10m, QP/dB(μV/m)
30~230	30
230~1000	37

Horizontal test datum

Sample No.	Frequency	Measuring value	Antenna Factor +Cable loss	Standard value	Over limit	Detector	Height	Azimuth
	MHz	dB(μV/m)	dB	dB(μV/m)	dB		cm	deg
11809192 840045	32.820200	16.1	2.0	30.0	-18.9	QP	290.0	/
	106.749800	11.2	-35.0	37.0	-11.0	QP	200.0	/
	762.914600	22.5	-36.0	37.0	-23.3	QP	280.0	/

**Horizontal Polarisation Worst Case Emissions Compliance Measurements 30 – 1000MHz**





**Radiated Emissions (cont.)**

**Results: Pass**

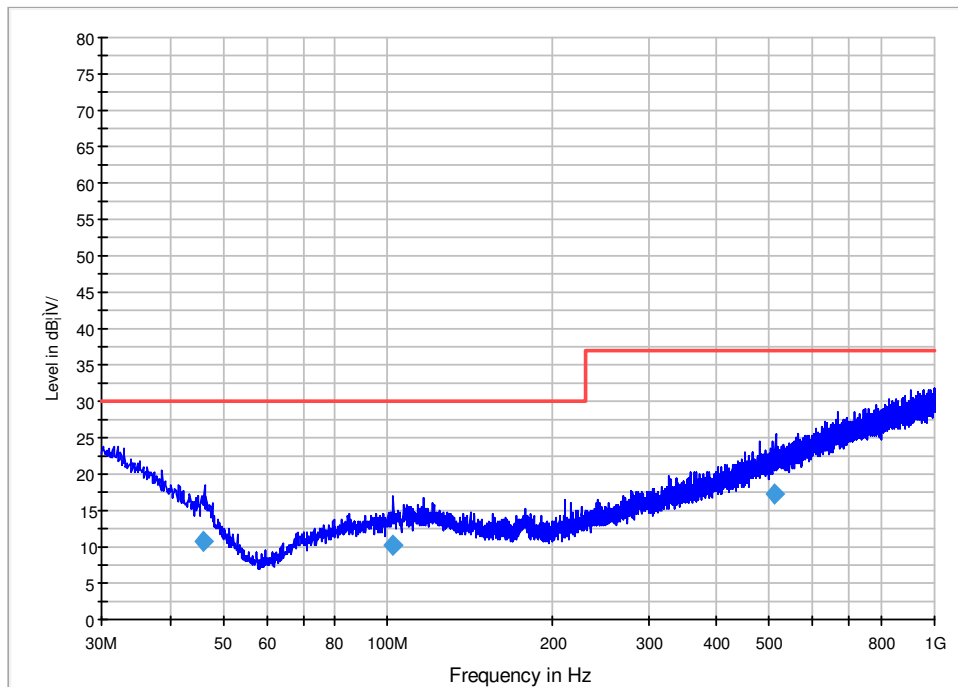
**Limit value of Class B equipments**

Frequency/MHz	Test distance 10m, QP/dB(μV/m)
30~230	30
230~1000	37

**Vertical test datum**

Sample No.	Frequency	Measuring value	Antenna Factor +Cable loss	Standard value	Over limit	Detector	Height	Azimuth
	MHz	dB(μV/m)	dB	dB(μV/m)	dB		cm	deg
11809192 840045	46.157000	10.7	19.0	30.0	-11.7	QP	100.0	/
	101.840800	10.2	-45.0	30.0	-10.9	QP	100.0	/
	511.594000	17.4	72.0	37.0	-19.2	QP	100.0	/

**Vertical Polarisation Worst Case Emissions Compliance Measurements 30 – 1000MHz**





## Conducted Emissions

Sample No: 11809192840045

Test Procedure: EN50470-1 Conducted Emissions

The meter was tested in accordance with EN55022 as follows:

### Environmental Conditions

Power Supply	230V, 50Hz
Temperature	21.5°C
Relative Humidity	56%
Barometric Pressure	998mB

The emissions on the AC mains were measured in the frequency range 0.15 – 30 MHz

### Operating Mode

The MUT was operated with voltage and auxiliary circuits energised with reference voltage and a current of between  $0.1I_{ref}$  and  $0.2I_{ref}$  and 1m leads attached to all terminals.



**Conducted Emissions (cont.)**

**Results: Pass**

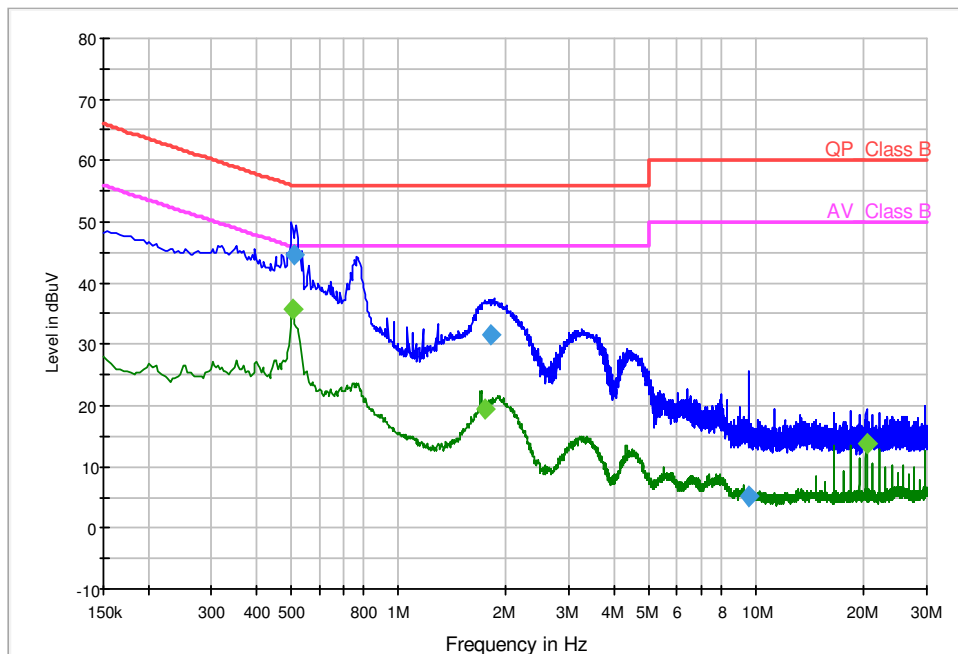
**Equipment Limit values**

Frequency(MHz)	AVG /dB( $\mu$ V)	QP /dB( $\mu$ V)
0.15~0.5	56~46	66~56
0.5~5	46	56
5~30	50	60

**Data of conducted emission(Line L1)**

Sample No.	Frequency	Measuring value	Corr. factors+ Cable loss	Standard value	Over Limit	Detector
	MHz	dB( $\mu$ V)	dB	dB( $\mu$ V)	dB	
11809192 840045	0.513000	44.7	10.1	65.6	-11.3	QP
	1.817000	31.7	10.1	56.0	-24.3	QP
	9.497000	5.0	10.3	60.0	-55.0	QP
	0.509000	35.8	10.1	46.0	-10.2	AVG
	1.751000	19.5	10.1	46.0	-26.5	AVG
	20.277000	13.8	10.5	50.0	-36.2	AVG

**Live Terminal Worst Case Emissions Compliance Measurements**





**Conducted Emissions (cont.)**

**Results: Pass**

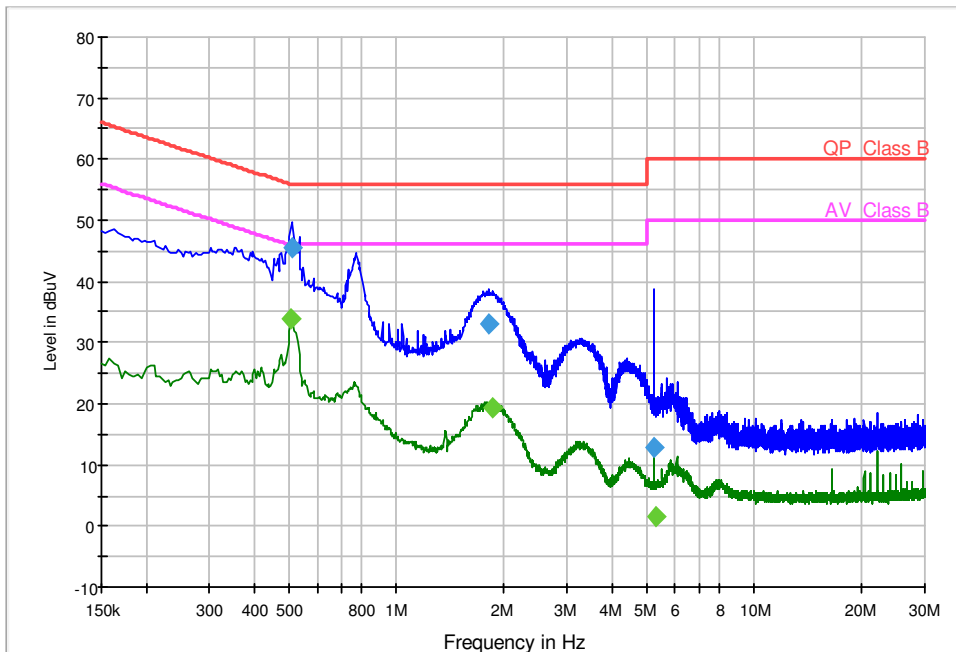
**Equipment Limit values**

Frequency(MHz)	AVG /dB( $\mu$ V)	QP /dB( $\mu$ V)
0.15~0.5	56~46	66~56
0.5~5	46	56
5~30	50	60

**Data of conducted emission(Line L2)**

Sample No.	Frequency	Measuring value	Corr. factors+ Cable loss	Standard value	Over Limit	Detector
	MHz	dB( $\mu$ V)	dB	dB( $\mu$ V)	dB	
11809192 840045	0.513000	45.6	10.1	65.6	-10.4	QP
	1.817000	33.0	10.1	56.0	-23.0	QP
	5.225000	12.9	10.2	60.0	-47.1	QP
	0.509000	34.0	10.1	46.0	-12.0	AVG
	1.861000	19.3	10.1	46.0	-26.7	AVG
	5.289000	1.7	10.2	50.0	-48.3	AVG

**Live Terminal Worst Case Emissions Compliance Measurements**





**Conducted Emissions (cont.)**

**Results: Pass**

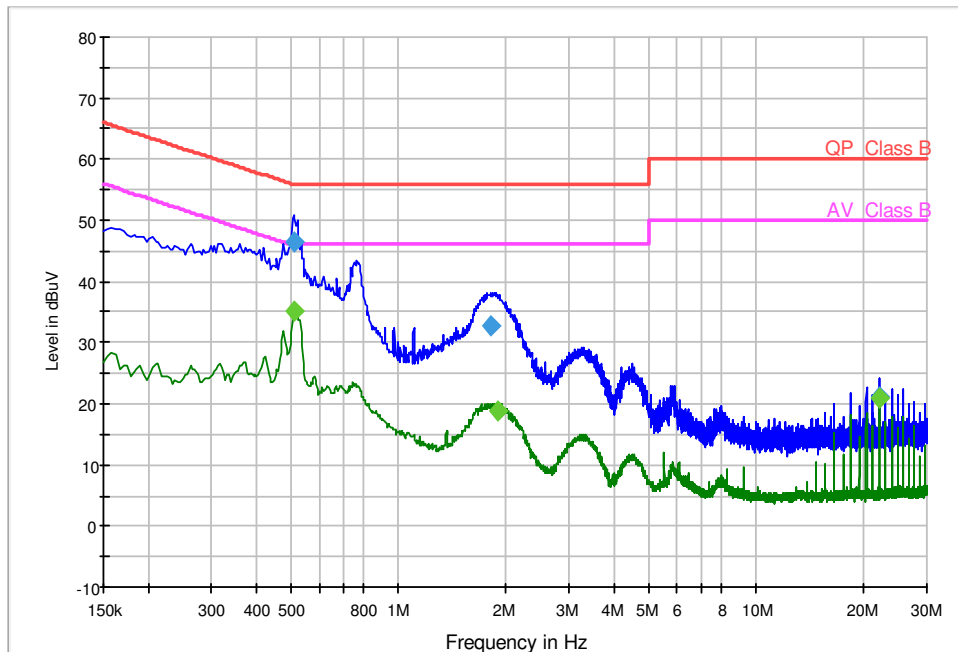
**Equipment Limit values**

Frequency(MHz)	AVG /dB(μV)	QP /dB(μV)
0.15~0.5	56~46	66~56
0.5~5	46	56
5~30	50	60

**Data of conducted emission(Line L3)**

Sample No.	Frequency	Measuring value	Corr. factors+ Cable loss	Standard value	Over Limit	Detector
	MHz	dB(μV)	dB	dB(μV)	dB	
11809192 840045	0.513000	46.5	10.1	56.0	-9.5	QP
	1.805000	32.7	10.1	56.0	-23.3	QP
	22.121000	21.1	10.7	60.0	-38.9	QP
	0.513000	35.3	10.1	46.0	-10.7	AVG
	1.909000	18.9	10.1	46.0	-27.1	AVG
	22.121000	20.9	10.7	50.0	-29.1	AVG

**Live Terminal Worst Case Emissions Compliance Measurements**





**Conducted Emissions (cont.)**

**Results: Pass**

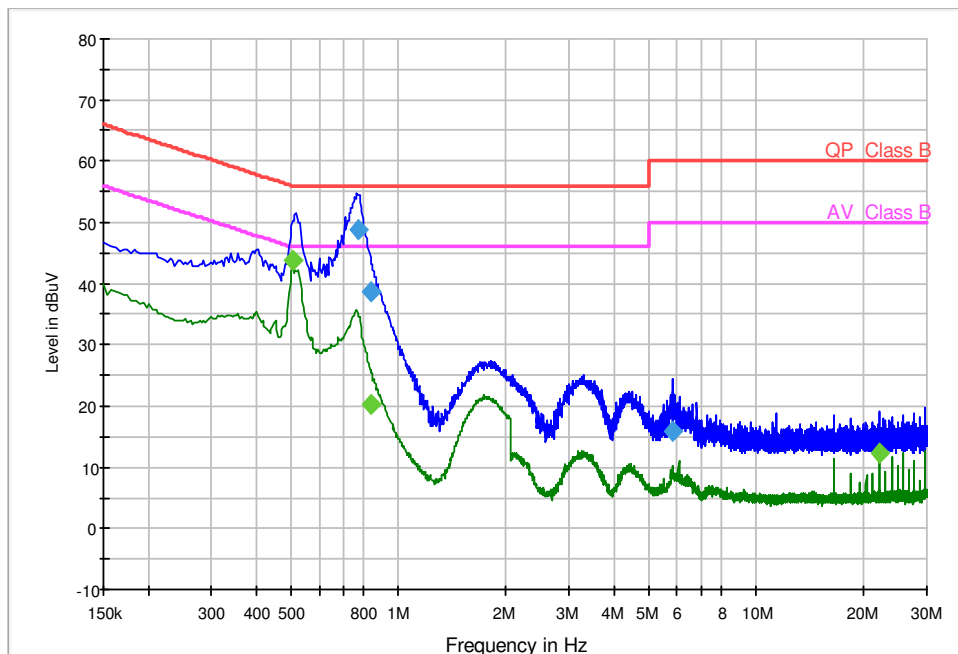
**Equipment Limit values**

Frequency(MHz)	AVG /dB(μV)	QP /dB(μV)
0.15~0.5	56~46	66~56
0.5~5	46	56
5~30	50	60

**Data of conducted emission(Line N)**

Sample No.	Frequency	Measuring value	Corr. factors+ Cable loss	Standard value	Over Limit	Detector
	MHz	dB(μV)	dB	dB(μV)	dB	
11809192 840045	0.773000	48.7	10.1	56.0	-7.3	QP
	0.833000	38.8	10.1	56.0	-17.2	QP
	5.865000	15.8	10.3	60.0	-44.2	QP
	0.505000	43.8	10.1	46.0	-2.2	AVG
	0.833000	20.3	10.1	46.0	-25.7	AVG
	22.121000	12.2	10.5	50.0	-37.8	AVG

**Neutral Terminal Worst Case Emissions Compliance Measurements**





**5.8 Magnetic Induction of External origin 0.5mT**

EN50470-1 X-Ref. 7.4.12  
 EN50470-3 X-Ref 8.7.7.11

AC magnetic induction of external origin, produced by a coil of one metre diameter, field strength at its centre 0.5mT (400 Ampere turns)

Sample No: 11809192840016	Test Procedure: EN50470-3 AC Mag Fields
---------------------------	---

Test Conditions: *Un: 3x230/400V* *Fn: 50Hz*  
*Iref: 10A* *PF: Cos.  $\phi = 1.0$*

Test Circuit: *3 phase 4 wire*

Measurement Mode: *Active Import Energy kWh*

Phase angle of the field with respect to U3 (Vph)	Direction of field orientation			Critical Change % Error Limit		
	X - X	Y - Y	Z - Z	Accuracy		
	% Error	% Error	% Error	Class A	Class B	Class C
No Field Applied	0.03	0.03	0.04	-	-	-
0°	0.03	0.03	0.03	±3.0	±2.0	±1.0
30°	0.03	0.03	0.02	±3.0	±2.0	±1.0
60°	0.03	0.01	0.03	±3.0	±2.0	±1.0
90°	0.02	0.03	0.04	±3.0	±2.0	±1.0
120°	0.03	0.02	0.03	±3.0	±2.0	±1.0
150°	0.03	0.03	0.03	±3.0	±2.0	±1.0
180°	0.01	0.02	0.03	±3.0	±2.0	±1.0
210°	0.03	0.03	0.01	±3.0	±2.0	±1.0
240°	0.03	0.03	0.03	±3.0	±2.0	±1.0
270°	0.01	0.03	0.03	±3.0	±2.0	±1.0
300°	0.03	0.03	0.03	±3.0	±2.0	±1.0
330°	0.03	0.03	0.03	±3.0	±2.0	±1.0
360°	0.03	0.03	0.03	±3.0	±2.0	±1.0





**5.9 Continuous Magnetic Induction of External Origin**

EN50470-1 X-Ref.7.4.11  
 EN50470-3 X-Ref 8.7.7.10

The continuous magnetic induction was obtained using an electromagnetic coil of 1000 Ampere-turns. This magnetic field was applied to all accessible surfaces of the meter samples when mounted as for normal use.

Sample No: 11809192840016	Test Procedure: EN50470-3 DC Magnetic Field P
---------------------------	---

Test Conditions: *Un: 3x230/400V Fn: 50Hz*  
*Iref: 10A PF: Cos. φ = 1.0*

Test Circuit: *3 phase 4 wire*

Measurement Mode: *Active Import Energy kWh*

Electromagnetic Position	% Error	Critical Change % Error Limit		
		Accuracy		
		Class A	Class B	Class C
No field applied	0.35	-	-	-
Left side of meter	0.36	±3.0	±2.0	±1.0
Front of meter	0.35	±3.0	±2.0	±1.0
Right side of meter	0.36	±3.0	±2.0	±1.0
Top of meter	0.36	±3.0	±2.0	±1.0

**6 CLIMATIC INFLUENCES**

EN50470-1 X-Ref. 6

**6.1 Dry Heat Test**

X-Ref. 6.3.2

Sample No: M13

Test Procedure: EN50470-1 Dry Heat

The meter was tested in accordance with IEC 60068-2-2 as follows:

Meter in the non-operating condition  
Method Bb (with gradual change of temperature)  
Temperature  $+70^{\circ}\text{C} \pm 2^{\circ}\text{C}$   
Duration of the test 72h

On completion of the above test, the meter was found to function correctly and within the accuracy specification when subsequently operated under reference operating conditions with no signs of damage or degradation in the meter's insulation properties.



## 6.2 Cold Test

X-Ref. 6.3.3

Sample No: M13

Test Procedure: EN50470-1 Cold

The meter was tested in accordance with IEC 60068-2-1 as follows:

Meter in the non-operating condition  
Method Ab (with gradual change of temperature)  
Temperature  $-25^{\circ}\text{C} \pm 3^{\circ}\text{C}$   
Duration of the test 72h

On completion of the above test, the meter was found to function correctly and within the accuracy specification when subsequently operated under reference operating conditions, with no signs of damage or corruption to meter register data.



### 6.3 Damp Heat Cyclic Test

X-Ref. 6.3.4

Sample No: M13

Test Procedure: EN50470-1 Damp Heat

The meter was tested in accordance with IEC 60068-2-30 as follows:

Meter with reference voltage applied

Upper Temperature of +40°C

Duration of the test: 6 cycles

On completion of the above test, the meter was found to function correctly and within the accuracy specification when subsequently operated under reference operating conditions with no signs of damage or degradation in the meter's insulation properties.



**7 MECHANICAL REQUIREMENTS**

EN50470-1 X-Ref. 5

**7.1 Vibration Test**

X-Ref. 5.2.2.3

Sample No: M2	Test Procedure: EN50470-1 Vibration
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**Environmental Conditions**

Temperature	21.4°C
Relative Humidity	58.3%
Barometric Pressure	998mB

The meter was tested in accordance with IEC 60068-2-6 as follows:

- Meter in the non-operating condition
- Test Procedure A
- Frequency Range of 10 Hz to 150 Hz (Transition frequency of 60 Hz)
- For  $F < 60$  Hz, constant amplitude of movement 0.075 mm
- For  $F > 60$  Hz, constant acceleration of  $9.8 \text{ m/s}^2$  (1g)
- 10 sweep cycles per axis

On completion of the above test, the meter was found to function correctly and within the accuracy specification when subsequently operated under reference operating conditions.



## 7.2 Shock Test

X-Ref. 5.2.2.2

Sample No: M2

Test Procedure: EN50470-1 Shock

### Environmental Conditions

Temperature	21.9°C
Relative Humidity	58.3%
Barometric Pressure	998mB

The meter was tested in accordance with IEC 60068-2-27 as follows:

Meter in the non-operating condition  
Half Sine Pulse  
Peak Acceleration of 30 gn (300 m/s<sup>2</sup>)  
Pulse Duration of 18 ms

On completion of the above test, the meter was found to function correctly and within the accuracy specification when subsequently operated under reference operating conditions.



### 7.3 Spring Hammer Test

X-Ref. 5.2.2.1

Sample No: M2	Test Procedure: EN50470-1 Spring Hammer
---------------	---

#### Environmental Conditions

Temperature	22.4°C
Relative Humidity	54.8%
Barometric Pressure	998mB

The meter was tested in accordance with IEC 60068-2-75 as follows:

Kinetic Energy of Spring Hammer  $0.2 \text{ Nm} \pm 0.02 \text{ Nm}$

The meter case and terminal cover were acted upon all external surfaces, including the display window. After the test no damage was evident and the meter continued to function correctly.



#### 7.4 Penetration of Dust & Water

X-Ref. 5.9

Sample No: SHES2207013595MI-M2

Test Procedure: EN50470-1 Dust & Water

The front of the meter was tested in accordance with IEC 60529 as follows:

Dust Test: IP5X, non-operating condition, Neither under, nor over pressure

Water Test: IPX1, non-operating condition

On completion of the above test, the meter was found to function correctly and within the accuracy specification when subsequently operated under reference operating conditions with no signs of damage or degradation in the meter's insulation properties.





## 7.5 Resistance to Heat & Fire

X-Ref. 5.8

Sample No: M5

Test Procedure: EN50470-1 Heat & Fire

The meter was tested in accordance with IEC 60695-2-11 as follows:

**Test:** Terminal block tested at 960°C for 30 seconds.

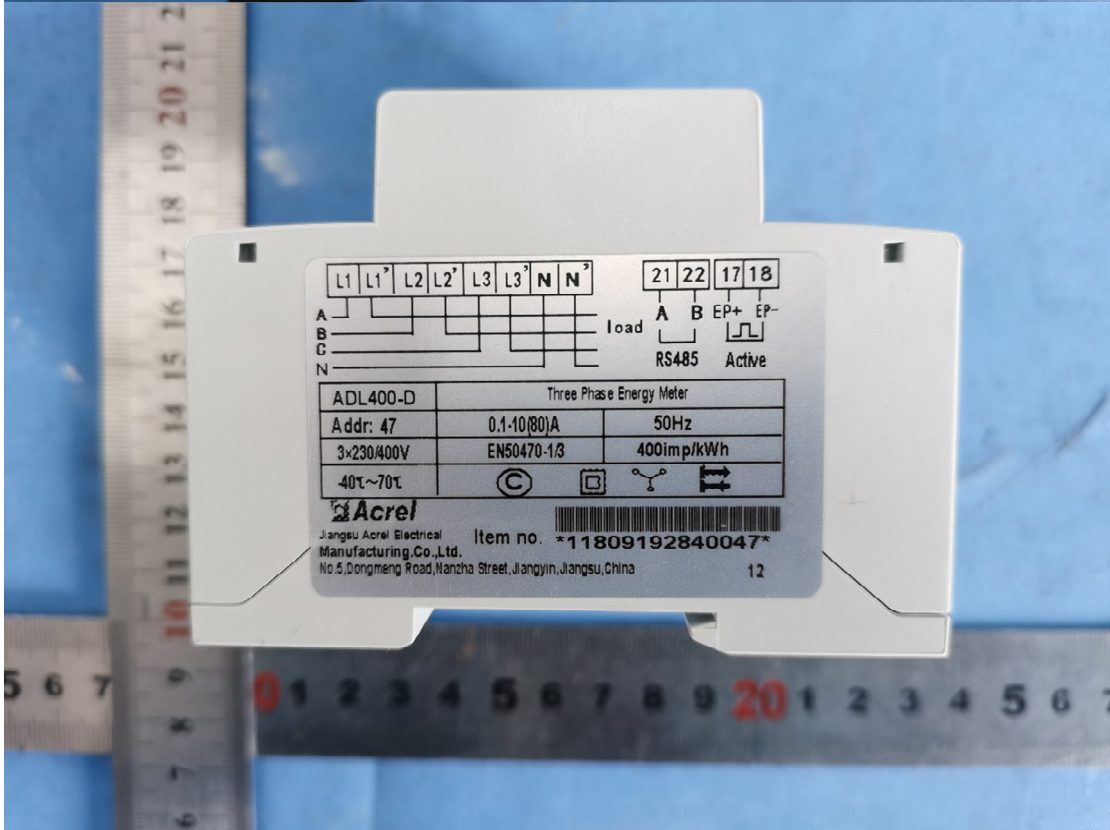
**Result:** Flames extinguish with 30 seconds

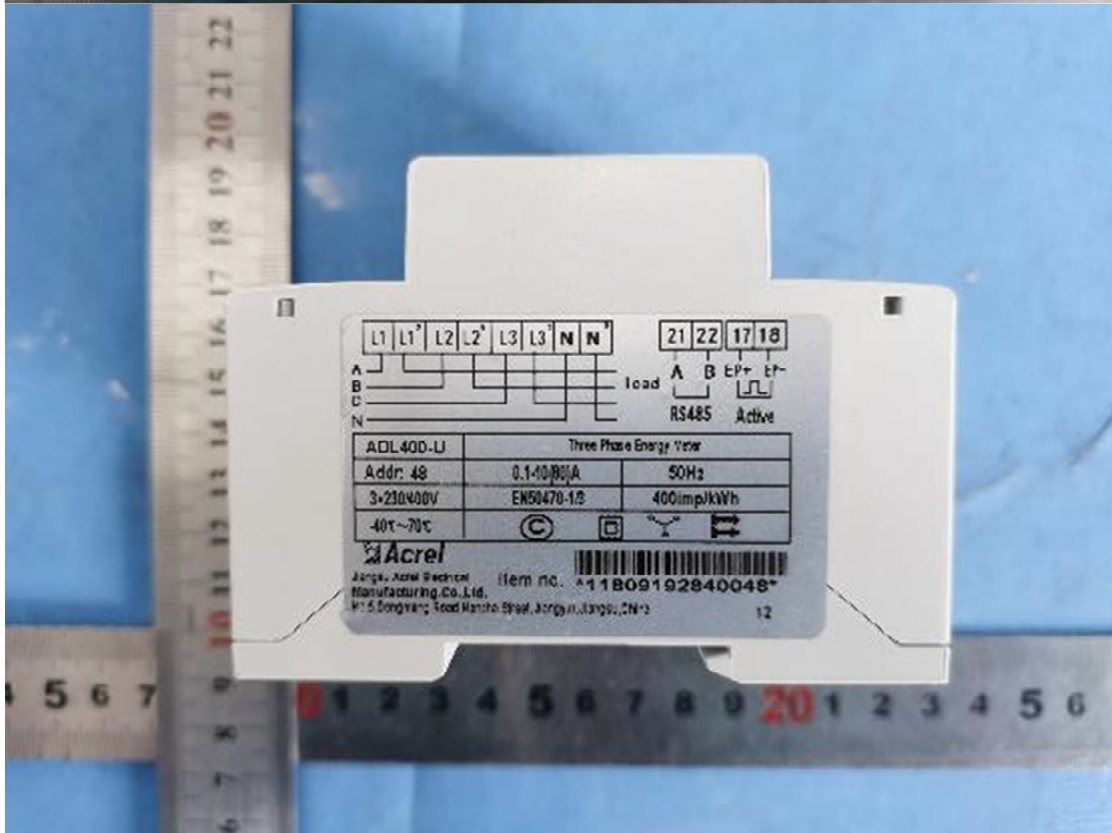
**Test:** Terminal cover and meter case tested at 650°C for 30 seconds.

**Result:** Does not produce drips or flames

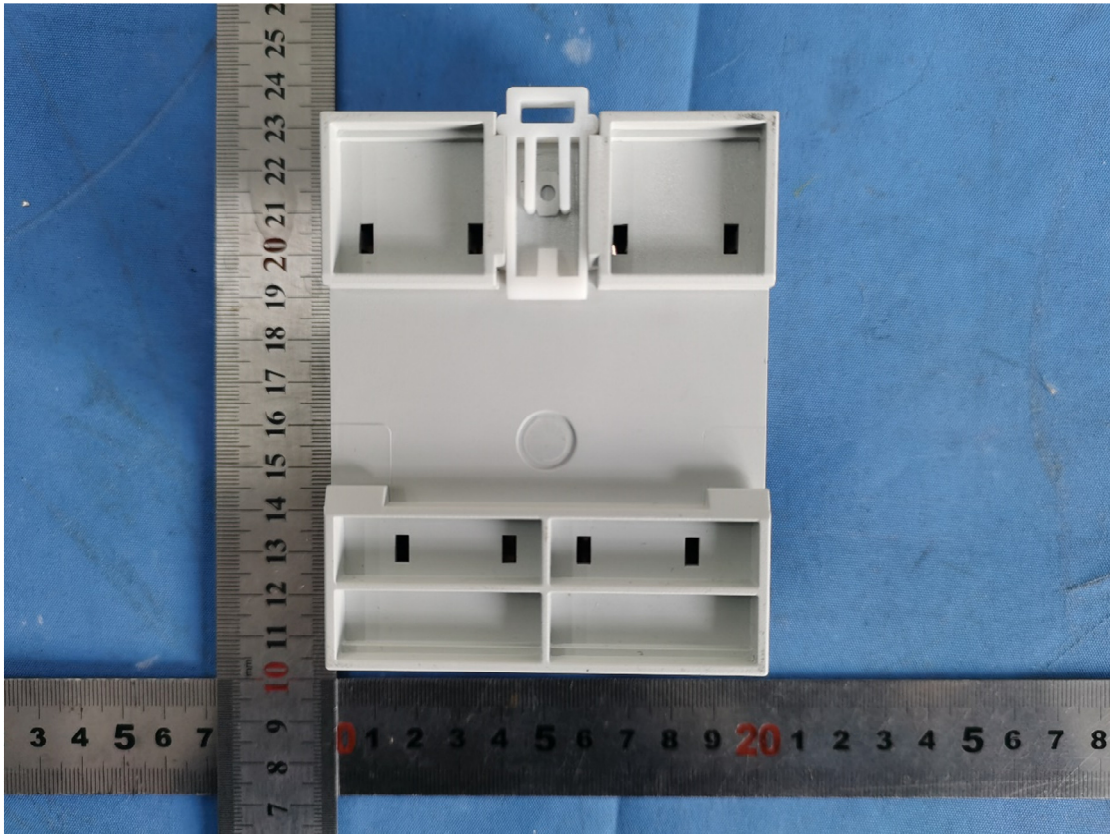
**ANNEX A - Photographs of Meter Under Test**

**Front of Meter Under Test**

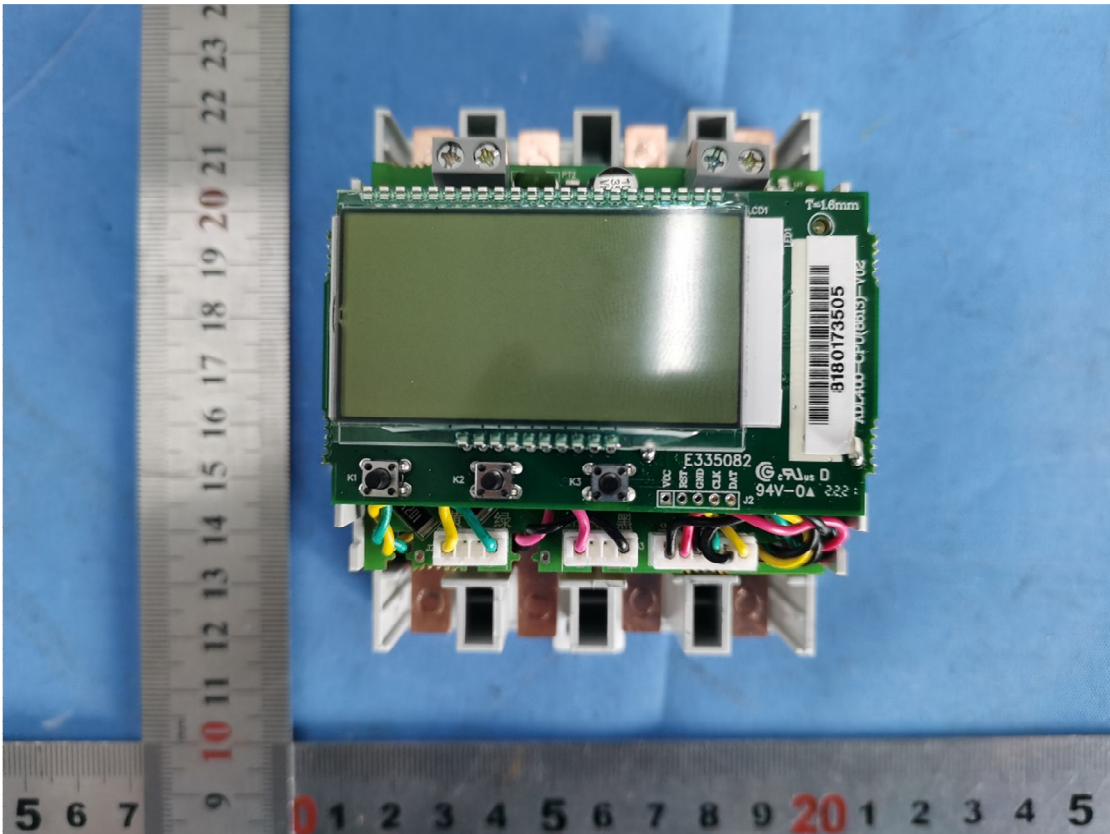


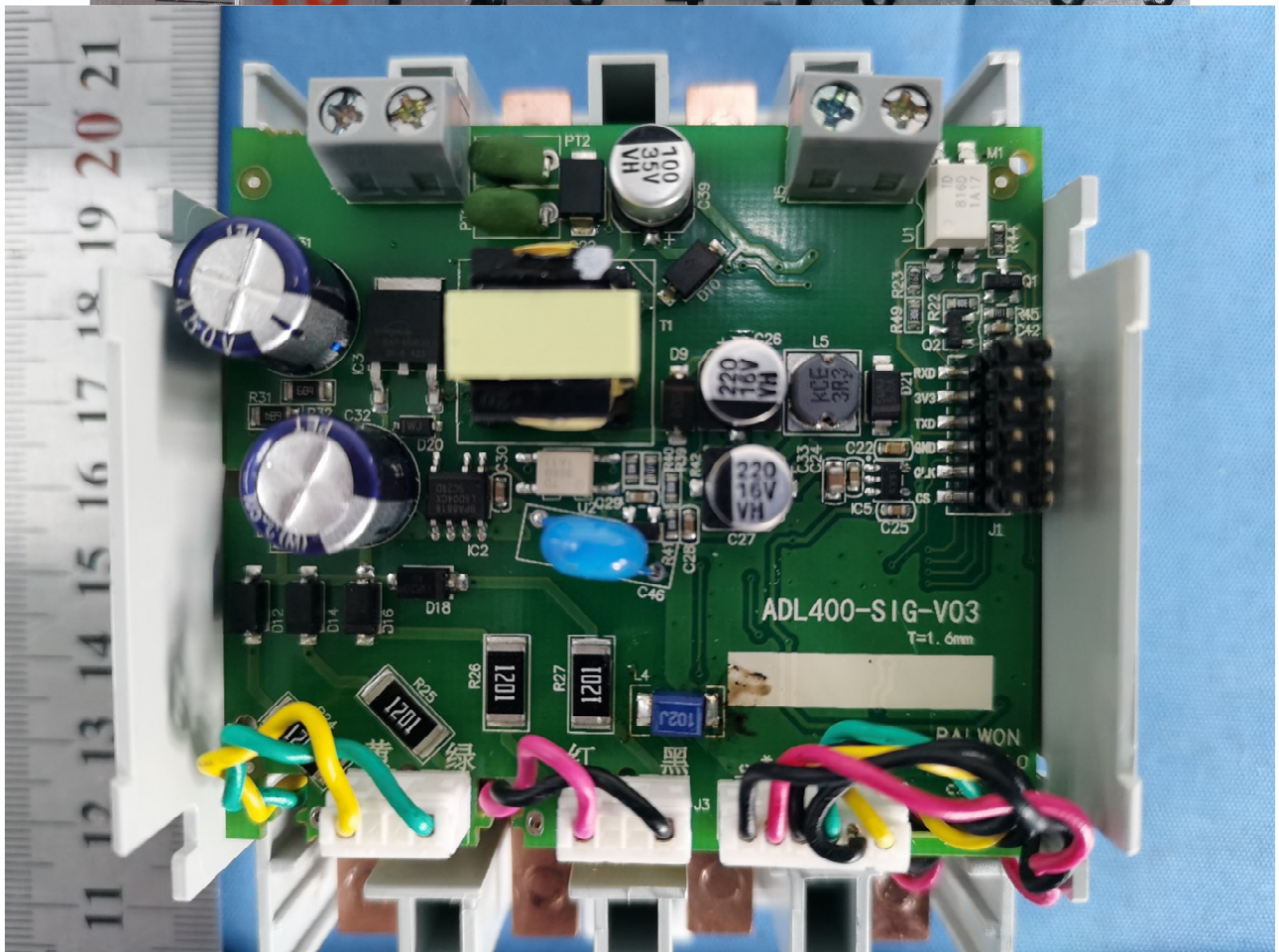


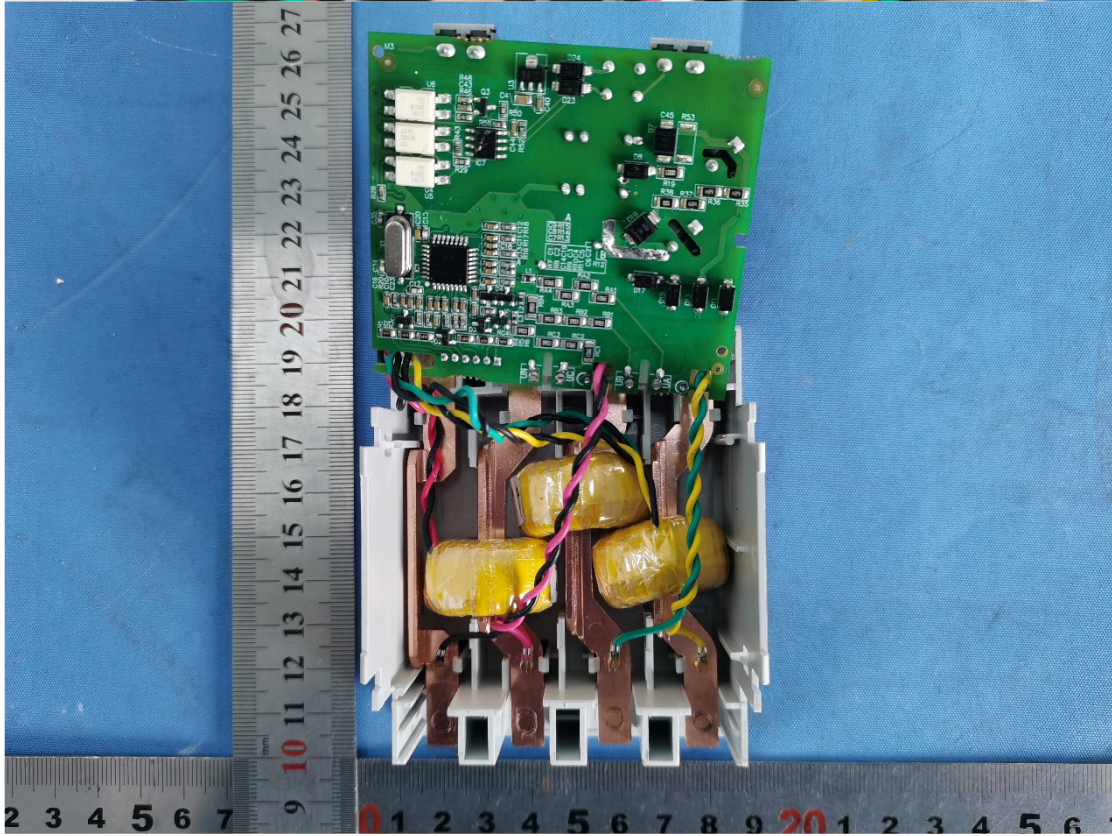
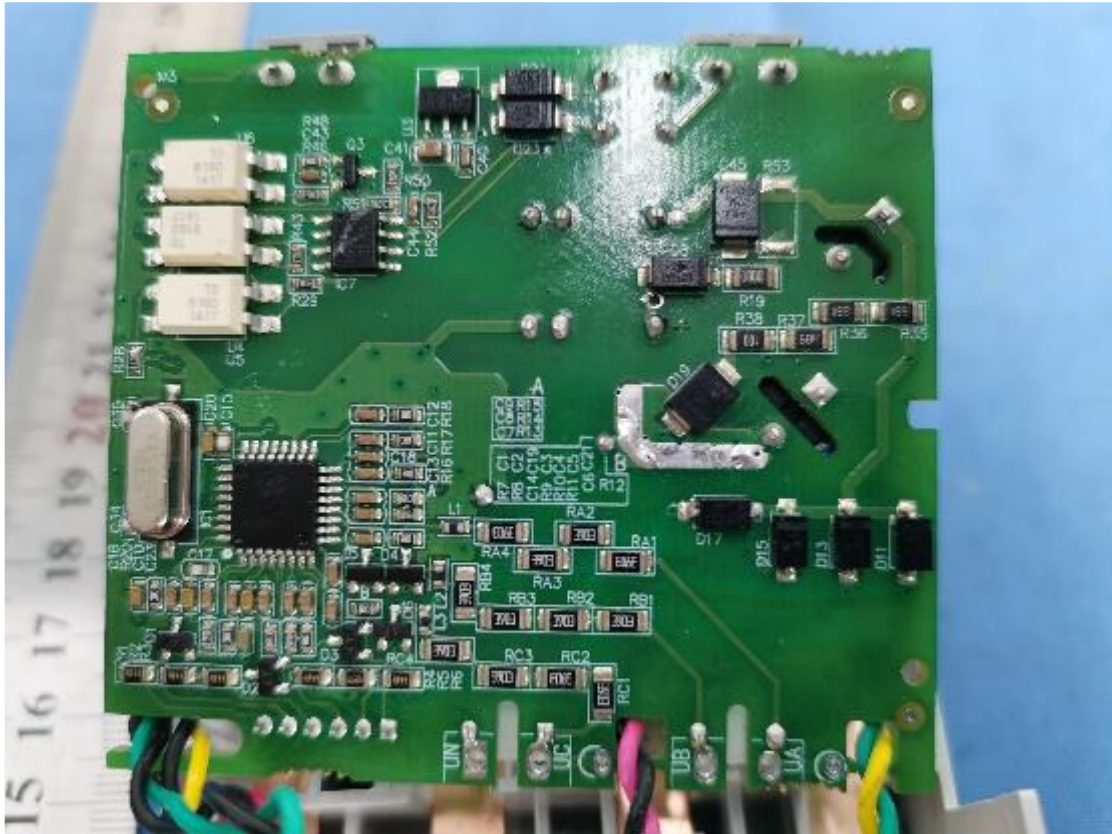
**Rear of Meter Under Test**



**Inside of Meter Under Test**







**\*\* End of Report \*\***