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Type test of a static three-phase energy meter, made by ELGAMA-ELEKTRONIKA, type EPQS 121.01.00 and EPQS 123.01.00, class 0,5S

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Calibration

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SUMMARY

The transformer operated static energy meter made by ELGAMA-ELEKTRONIKA, type EPQS 121.01.00 and EPQS 123.01.00, class 0,5S, was tested according to the requirements laid down in

- IEC 60687: "Alternating current static watt-hour meters for active energy (classes 0,2S and 0,5S)", for class 0,5S.

This publication only concerns active energy meters. The energy meters under test were also tested for varh measurements with similar requirements as stated in the mentioned publication. The reactive energy influence test results (see section 3.3.2) are not mentioned whenever the variations in the error are comparable with the active energy test results.

All requirements were met.

1 INTRODUCTION

The type test was carried out in the Calibration Laboratory of KEMA, from December 2002 to March 2003, on behalf of ELGAMA-ELEKTRONIKA, on static three-phase energy meters, manufactured by ELGAMA-ELEKTRONIKA, type EPQS 121.01.00 and EPQS 123.01.00, class 0,5S.
The energy meters were tested in respect of the following:

- Requirements laid down in IEC 60687: "Alternating current static watt-hour meters for active energy (classes 0,2S and 0,5S)".
- The same requirements as stated in IEC 60687 for reactive energy.

The code number in brackets at the beginning of each test section in this report refers to the relevant section in IEC 60687.

2 DATA RELATING TO THE ENERGY METERS TESTED AND ADDITIONAL INFORMATION ABOUT THE TYPE TEST

Manufacturer	:	ELGAMA-ELEKTRONIKA
Type	:	EPQS 121.01.00 and EPQS 123.01.00
Class	:	0,5S
Nominal current (I_n)	:	3 x 5 A respectively 3 x 1 A
Maximum current	:	3 x 6 A respectively 3 x 1,2 A
Voltage range	:	3 x 57,7…230 / 100…400 V
Rated frequency	:	50 Hz
Manufacturer Nos.	:	101398, 101406, 101408, 101411 and 101412
Meter constants	:	1000 imp/kWh 1000 imp/kvarh

The results stated in this report concern the meters with serial numbers 101398 and 101408 unless stated otherwise. The reference voltage is 3 x 230 V while the rated frequency is 50 Hz, unless stated otherwise.

The tests were carried out in conformity with IEC 60687/61268 using a static standard watt-hour and var-hour meter. The precisely known corrections were taken into account in determining the errors of the energy meters examined.

3 RESULTS OF THE TYPE TEST

3.1 (5.2) Tests of the mechanical properties

3.1.1 GENERAL

In order to evaluate the materials used and the construction of the meter tested, the meter was assessed with regard to the following points.

3.1.2 CASE

The meter can be sealed in such a way that the inside of the meter is only accessible after breaking the seals.

After carrying out the spring hammer test according to IEC publication 60068-2-75 with a kinetic energy of 0,2 J, it may be said that the mechanical strength of the meter case of the energy meter is sufficient.

A shock test was performed according to IEC 60068-2-27, with a half-sine pulse, a peak acceleration of 150 m/s^2 and a pulse duration of 11 ms. After this test the meter showed no damage.

A vibration test according to IEC 60068-2-6 was carried out on the meters in non-operating condition, frequency range from 10 Hz to 150 Hz, with a constant movement amplitude of 0,035 mm up to 60 Hz and a constant acceleration of 4,9 m/s^2 above 60 Hz. Per axis 10 sweep cycles were carried out. After the test the meter showed no damage.

3.1.4 TERMINALS AND TERMINAL BLOCK

The clearances and creepage distances in the terminal block are adequate.

3.1.5 NON-FLAMMABILITY

The material of both the terminal block and the meter case was subjected to a glow-wire test in accordance with IEC 60695-2-1. The temperature of the glow-wire when testing the terminal blocks, the meter case and the meter front, was 650 °C . The material meets the requirements.

3.1.6 PROTECTION AGAINST PENETRATION OF DUST AND WATER

The test was carried out according to IEC 60529, protection degree IP51. The results met the requirements.

The meter meets the requirements.

3.2 Tests of climatic influences
(5.3)

3.2.1 GENERAL

One meter was subjected to the climatic tests. In order to evaluate the materials used and the construction of the meter tested, the relevant meter was assessed with regard to the following points.

3.2.2 DRY HEAT TEST

The test was carried out according to IEC 60068-2-2, at a temperature of 70 °C for a duration of 72 hours.

Afterwards, the meter showed no damage or loss of information.

3.2.3 COLD TEST

The test was carried out according to IEC 60068-2-1, at a temperature of –25. °C for a duration of 72 hours.

Afterwards the meter showed no damage or loss of information.

3.2.4 DAMP HEAT CYCLIC TEST

The test was carried out according to IEC 60068-2-30 (variant 1) with an upper temperature of 40 °C for 6 cycles.

An insulation test was carried out 24 hours after the meter was tested (see section 3.9). The requirements were met. The meter showed no damage or loss of information.

3.3 Tests of the metrological properties

3.3.1 CONDITIONS UNDER WHICH THE TYPE TEST TOOK PLACE
(5.6)

The meters were examined at an ambient temperature of (23 ± 2) °C and after the voltage circuits had been connected to a voltage of 3 x 230 for at least 2 hours.

The measuring conditions were as specified in section 5.6.1 of IEC publication 60687. The measurements were made with an accurate static watt-hour and var-hour meter.

The percentage error of the meter can be expressed as follows:

$$p = \frac{PM - PA}{PA} \times 100\%$$

in which p = percentage error
PM = energy recorded by meter
PA = actual energy.

The values for the errors registered at different currents, both balanced and single-phase, and various values for cos φ and sin φ, at a voltage of 3 x 230 V and 3 x 57,7 V with rated frequency, can be found in annex 1. The results show that the static energy meters, under the reference conditions given in section 5.6.1 of IEC 60687, meet the requirements given in section 4.6.1 of IEC 60687.

3.3.2 EFFECT OF CHANGE OF INFLUENCE QUANTITIES ON ACCURACY

The tests were performed on the energy meters with serial numbers 101398 and 101408.

3.3.2.1 The effect of ambient temperature
(4.6.3)

The meter was placed into a room with ambient temperatures as shown in the table below until thermal equilibrium was reached. The measured deviations in the errors are shown in the following table.

The meter with serial number 101398 was used to verify influence on Wh measurement:

I in % of I_n	cos φ	variation of the error in % in relation to the error at 23 ºC			maximum variation per K in % for the temperature range considered.	
		8 ºC	23 ºC	38 ºC		
5	1	- 0,08	0,00	+ 0,08	0,006	(req.: ≤ 0,03)
10	0,5 lag.	- 0,12	0,00	+ 0,13	0,009	(req.: ≤ 0,05)
100	1	- 0,10	0,00	+ 0,09	0,007	(req.: ≤ 0,03)
100	0,5 lag.	- 0,07	0,00	+ 0,10	0,007	(req.: ≤ 0,05)
120	1	- 0,11	0,00	+ 0,08	0,008	(req.: ≤ 0,03)
120	0,5 lag.	- 0,09	0,00	+ 0,11	0,008	(req.: ≤ 0,05)

The meter with serial number 101408 was used to verify influence on varh measurement:

I in % of I_n	sin φ	variation of the error in % in relation to the error at 23 ºC			maximum variation per K in % for the temperature range considered.	
		8 ºC	23 ºC	38 ºC		
5	1	- 0,08	0,00	+ 0,10	0,003	(req.: ≤ 0,03)
10	0,5 lag.	- 0,05	0,00	+ 0,07	0,005	(req.: ≤ 0,05)
100	1	- 0,11	0,00	+ 0,10	0,008	(req.: ≤ 0,03)
100	0,5 lag.	- 0,11	0,00	+ 0,08	0,008	(req.: ≤ 0,05)
120	1	- 0,11	0,00	+ 0,08	0,008	(req.: ≤ 0,03)
120	0,5 lag.	- 0,09	0,00	+ 0,09	0,006	(req.: ≤ 0,05)

The energy meters examined meet the requirements of section 4.6.3 of IEC publication 60687.

3.3.2.2 Effect of changes in the auxiliary supply voltage
(4.6.2)

Not applicable. The meter is supplied from the AC mains (any one of the three connectors for voltage measurement).

3.3.2.3 Effect of measuring voltage changes on the accuracy at rated frequency
(4.6.2)

The maximum change measured in the error due to a 10% change of the measuring voltage was less than 0,05% in all cases (requirement ≤ 0,2% for cos φ = 1 and ≤ 0,4% for cos φ = 0,5 lagging). This test was performed with a reference voltage of 230 V and 57,7 V. Also measuring varh the requirements are met (< 0,1 %).

3.3.2.4 Effect of frequency changes on the accuracy
(4.6.2)

The maximum change measured in the error due to a 5% change of frequency was less than 0,05% for both energy meters, for measurement of both Wh (cos φ = 1 and 0,5) and varh (sin φ = 1 and 0,5) as described in the standards. (Strictest requirement ≤ 0,2% at cos φ = 1.)

3.3.2.5 Effect of a magnetic induction of external origin of 0,5 mT on the accuracy
(4.6.2)

An external magnetic field was generated using a round coil measuring 1 meter in diameter. The coil was placed parallel to printed circuit boards of the energy meters. The phase position of the field current (with respect to the measuring voltage) was shifted between 0° and 360°.

The maximum change measured at reference voltage, nominal current, rated frequency and cos φ = 1 was less than 0,2%. The maximum permissible change allowed by IEC 60687 is 1,0%.

3.3.2.6 Effect of a third harmonic in the current on the accuracy
(4.6.2)

Using a harmonic generator, 10% of third harmonic in the current was injected into the current circuits. The phase position of the third harmonic (with respect to the measuring voltage) was shifted between 0° and 360°. The maximum change in the error was less than 0,02% in all cases. The maximum permissible change allowed by IEC 60687 is 0,1%.

3.3.2.7 Effect of the phase sequence
(4.6.2)

The change in the error with reversed phase sequence compared with the error with normal phase sequence measured at reference voltage and rated frequency, 10% of the nominal current and cos φ = 1 was 0,00% for both energy meters. The maximum permissible change allowed by IEC 60687 for a class 0,5S meter is 0,1%.

3.3.2.8 Effect of voltage unbalance
(4.6.2)

The influence of an interruption of one phase of the three-phase network, at reference voltage, rated frequency and nominal current, on the accuracy of the meter was less than 0,02% for both meters; the influence of an interruption of two phases was 0,05% (requirement ≤ 1,0%).

3.3.2.9 Effect of a continuous magnetic induction of external origin
(4.6.2)

The magnetic field was generated using an electromagnet as described in annex C of IEC 60687. The change in the error due to this magnetic field was 0,00% (requirement ≤ 3,0%).

3.3.2.10 Effect of an electromagnetic HF field
(4.6.2)

See section 3.6.

The results show that the energy meters tested meet the requirements of section 4.6 of IEC 60687.

3.3.3 EFFECT OF SHORT-TIME OVERCURRENTS ON THE ACCURACY
(4.4.3)

A current of 120 A (EPQS 121.01.00, serial number 101398) respectively 24 A (EPQS 123.01.00, serial number 101412), corresponding with 20 x I_{max} flowed through the current circuits of the energy meters for a period of 0,5 seconds, with the voltage circuits being supplied at reference voltage and rated frequency. The effect of this test on the accuracy of the energy meter at reference conditions was less than 0,02%. The maximum permissible deviation allowed by IEC 60687 is 0,05%.

The energy meters tested meet the requirements of section 4.4.3 of IEC 60687.

3.3.4 THE EFFECT OF SELF-HEATING ON THE ACCURACY
(4.4.4)

The changes in the error as a result of self-heating with I_{max}, measured at reference voltage, rated frequency, cos φ = 1 and also at cos φ = 0,5 lagging, are shown in the table below. The changes were measured at regular intervals for 60 minutes after connecting the current.

energy meter serial number	maximum change in %			
	Wh cos φ = 1	Wh cos φ = 0,5 lag.	varh sin φ = 1	varh: sin φ = 0,5 lag.
101398	0,05 (req. ≤ 0,2)	0,05 (req. ≤ 0,2)		
101408			0,1	0,1

The results show that the meters tested meet the requirements.

3.3.5 POWER CONSUMPTION OF THE VOLTAGE AND CURRENT CIRCUITS
(4.4.1)

The results of the power consumption measurements for the meters with serial numbers 101398 and 101412 are shown in the table below (measured with a voltage of 230 V and a current of 5 A).

Circuit	power consumption serial No. 101398 (5A)	serial No. 101412 (1A)
Voltage circuit 1(R) *	3,40 VA (1,66 W)	3,34 VA (1,62 W)
Current circuit 1(R)	0,20 VA	0,09 VA
Current circuit 2(S)	0,20 VA	0,09 VA
Current circuit 3(T)	0,20 VA	0,09 VA

* The supply load is divided over the three phases. Minor differences in the voltages of the phases results in different distribution. The consumption was therefore measured on a single phase (R), with only this phase powered. The other phases measure the same value when applied the same way.

The maximum permissible power consumption for the voltage circuits is 10 VA and 2 W (per phase and including the power supply) and for the current circuits 1 VA, so the meters tested meet the requirements of section 4.4.1 of IEC 60687.

3.3.6 STARTING AND RUNNING WITH NO LOAD
(4.6.4)

3.3.6.1 Starting
(4.6.4)

The minimum load at which the energy meters tested recorded at reference voltage, rated frequency and cos $\varphi = 1$ (Wh) respectively sin $\varphi = 1$ (varh) was, for both energy meters, 0,10% of I_n (req. $\leq$ 0,1% I_n for active energy).

3.3.6.2 Running with no load
(4.6.4)

At zero current, rated frequency and a voltage of 264,5 V, no pulse was generated by the energy meters tested.

The energy meters tested meet the requirements of section 4.6.4 of IEC 60687.

3.4 Disturbance voltage tests

The disturbance voltage tests, described in section 5.5.4 of IEC 60687, were performed on the energy meter with serial number 101408.

3.4.1 TEST METHOD

In normal circumstances the current circuits of the watt-hour meter will carry current if there are disturbances in the voltages. Therefore, in contrast to the provisions of section 5.5 of IEC 60687, the tests were carried out with current circuits carrying both zero and rated current. For an easily obtainable constant recorded load the voltage circuits were connected in parallel and the current circuits in series.

3.4.2 TEST CARRIED OUT WITH DISTURBANCE VOLTAGES
(5.5.4)

The following disturbance voltage tests were carried out:

- fast transient test 5/50 ns

3.4.3 TEST LEVELS

The disturbance voltage amplitudes used are mentioned in the "requirement" column of annex 2.

3.4.4 TEST RESULTS

The results of the measurements are mentioned in annex 2. The energy meter meets the requirements.

3.5 Test with electrostatic discharges
(5.5.2)

The test was performed on the energy meter with serial No. 101408.

3.5.1 TEST LEVELS

A discharge voltage of 15 kV was applied conform IEC 60687.

3.5.2 TEST RESULTS

The tests with a discharge voltage of 15 kV did not cause any disturbances of the meter functions. The requirements were met.

3.6 Test with an electromagnetic HF field
(4.6.2)

The test was performed on the energy meter with serial No. 101408.

3.6.1 TEST LEVELS

The test with an electromagnetic field was carried out in a GTEM cell in the frequency range from 150 kHz to 1 GHz at a field strength of 10 V/m. The meter was tested at nominal current at a voltage of 230 V.

3.6.2 TEST RESULTS

The measured error change of the meter due to the electromagnetic field was less than 1%. The maximum allowed variation according to IEC 60687 is 2%.
The requirements are met.

3.7 Radio interference measurement
(5.5.5)

The test was performed on the energy meter with serial No. 101408.

3.7.1 TEST LEVELS

The test levels were taken from IEC 60687. The test was carried out according to CISPR 14, clause 6 and 7.

3.7.2 TEST RESULTS

The maximum peak values measured in the frequency range from 0,15 MHz to 30 MHz (according to clause 6 of CISPR 14) were
64 dB(µV), measured at 170 kHz. The maximum allowed peak value at this frequency is 65 dB(µV). 61 dB(µV), measured at 240 kHz. The maximum allowed peak value at this frequency is 62 dB(µV).

In the frequency range from 30 to 300 MHz (clause 7 of CISPR 14) the maximum peak value measured was less than 25 dB(pW) for the voltage and current circuits together at all frequencies. The maximum allowed peak value in this frequency range is 45 dB(pW) at 30 MHz to 55 dB(pW) at 300 MHz.

The requirements were met.

3.8 Test with line voltage deviations
(5.4.2)

The test was performed on the energy meter with serial No. 101408.

3.8.1 TEST LEVELS

The test levels were taken from section 5.4.2 of IEC publication 60687.

3.8.2 TEST RESULTS

The results of the measurements are mentioned in annex 3. The requirements are met.

3.9 Dielectric tests
(5.4.6)

The following tests were carried out:
- Impulse voltage withstand test (1,2/50 µs) with a test voltage of 6 kV.
- Test with 50 Hz voltage during 1 minute.

The tests were performed on the energy meters with serial No. 101408 and 101412.

3.9.1 TEST LEVELS

The test levels were taken from section 5.4.6 of IEC 60687.

3.9.2 TEST RESULTS

The results of the measurements are shown in annex 4. During the tests no flashovers were observed. After these tests had been carried out no degradation in the measured insulation resistance was found.
The requirements were met.

Accuracy test results EPQS 121.01.00, serial No. 101398

(Wh) 230 V

I in % of I_n	3/1 ph	percentage error at cos φ = 1	0,5 lagging	0,8 leading
1	3ph	+ 0,24		
2	3ph	+ 0,13	+ 0,47	+ 0,05
5	3ph	+ 0,05	+ 0,30	0,00
5	1ph,1	+ 0,08		
5	1ph,2	+ 0,03		
5	1ph,3	+ 0,04		
10	3ph	+ 0,06	+ 0,23	- 0,03
10	1ph,1		+ 0,27	
10	1ph,2		+ 0,24	
10	1ph,3		+ 0,25	
20	3ph	+ 0,03	+ 0,16	- 0,01
50	3ph	+ 0,03	+ 0,05	+ 0,02
100	3ph	+ 0,03	- 0,02	+ 0,04
100	1ph,1	+ 0,01	- 0,02	
100	1ph,2	+ 0,03	- 0,02	
100	1ph,3	- 0,01	- 0,02	
120	3ph	+ 0,03	0,00	+ 0,07
120	1ph,1	+ 0,05	+ 0,01	
120	1ph,2	+ 0,06	- 0,01	
120	1ph,3	+ 0,01	0,00	

Accuracy test results EPQS 121.01.00, serial No. 101398

(varh) 230 V

I in % of I_n	3/1 ph	percentage error at sin φ = 1	0,5 lagging	0,5 leading
1	3ph	0,00		
2	3ph	+ 0,02	- 0,28	+ 0,30
5	3ph	- 0,03	- 0,27	+ 0,23
5	1ph,1	- 0,03		
5	1ph,2	- 0,04		
5	1ph,3	- 0,07		
10	3ph	- 0,03	- 0,23	+ 0,17
10	1ph,1		- 0,20	
10	1ph,2		- 0,24	
10	1ph,3		- 0,29	
20	3ph	- 0,03	- 0,20	+ 0,10
50	3ph	- 0,05	- 0,10	
100	3ph	- 0,05	- 0,04	- 0,06
100	1ph,1	- 0,01	- 0,02	
100	1ph,2	- 0,04	+ 0,02	
100	1ph,3	- 0,06	- 0,10	
120	3ph	- 0,03	- 0,01	- 0,05
120	1ph,1	- 0,03	+ 0,01	
120	1ph,2	+ 0,02	+ 0,05	
120	1ph,3	- 0,04	- 0,06	

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Accuracy test results EPQS 121.01.00, serial No. 101408

(Wh) 230 V

I in % of I_n	3/1 ph	percentage error at cos φ = 1	0,5 lagging	0,8 leading
1	3ph	+ 0,10		
2	3ph	+ 0,01	+ 0,27	- 0,13
5	3ph	+ 0,02	+ 0,26	- 0,08
5	1ph,1	+ 0,04		
5	1ph,2	+ 0,03		
5	1ph,3	+ 0,02		
10	3ph	+ 0,02	+ 0,21	- 0,07
10	1ph,1		+ 0,21	
10	1ph,2		+ 0,17	
10	1ph,3		+ 0,24	
20	3ph	+ 0,01	+ 0,15	- 0,05
50	3ph	0,00	+ 0,04	- 0,02
100	3ph	0,00	0,00	0,00
100	1ph,1	- 0,05	+ 0,05	
100	1ph,2	- 0,01	- 0,05	
100	1ph,3	0,00	+ 0,02	
120	3ph	+ 0,01	0,00	+ 0,03
120	1ph,1	- 0,01	+ 0,05	
120	1ph,2	+ 0,03	- 0,05	
120	1ph,3	+ 0,01	+ 0,05	

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Accuracy test results EPQS 121.01.00, serial No. 101408

(varh) 230 V

I in % of I_n	3/1 ph	percentage error at sin φ = 1	0,5 lagging	0,5 leading
1	3ph	+ 0,03		
2	3ph	- 0,05	- 0,36	+ 0,29
5	3ph	- 0,04	- 0,35	+ 0,26
5	1ph,1	- 0,01		
5	1ph,2	- 0,06		
5	1ph,3	- 0,06		
10	3ph	- 0,05	- 0,30	+ 0,18
10	1ph,1		- 0,36	
10	1ph,2		- 0,27	
10	1ph,3		- 0,29	
20	3ph	- 0,06	- 0,23	+ 0,10
50	3ph	- 0,07	- 0,15	
100	3ph	- 0,07	- 0,12	- 0,01
100	1ph,1	- 0,08	- 0,10	
100	1ph,2	- 0,01	- 0,07	
100	1ph,3	- 0,09	- 0,11	
120	3ph	- 0,06	- 0,07	- 0,03
120	1ph,1	- 0,07	- 0,11	
120	1ph,2	- 0,04	- 0,05	
120	1ph,3	- 0,06	- 0,10	

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Accuracy test results EPQS 121.01.00, serial No. 101408

(Wh) 57,7 V

I in % of I_n	3/1 ph	percentage error at cos φ =		
		1	0,5 lagging	0,8 leading
1	3ph	- 0,03		
2	3ph	- 0,06	+ 0,13	- 0,20
5	3ph	- 0,02	+ 0,17	- 0,13
5	1ph,1	- 0,04		
5	1ph,2	- 0,03		
5	1ph,3	0,00		
10	3ph	- 0,02	+ 0,15	- 0,10
10	1ph,1		+ 0,14	
10	1ph,2		+ 0,10	
10	1ph,3		+ 0,19	
20	3ph	- 0,02	+ 0,10	- 0,09
50	3ph	- 0,03	+ 0,01	- 0,05
100	3ph	0,00	- 0,03	- 0,01
100	1ph,1	- 0,01	- 0,01	
100	1ph,2	+ 0,01	- 0,07	
100	1ph,3	0,00	- 0,01	
120	3ph	0,00	- 0,03	- 0,01
120	1ph,1	0,00	- 0,01	
120	1ph,2	+ 0,02	- 0,08	
120	1ph,3	- 0,01	- 0,01	

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Accuracy test results EPQS 123.01.00, serial No. 101412

(Wh) 230 V

I in % of I_n	3/1 ph	percentage error at cos φ = 1	0,5 lagging	0,8 leading
1	3ph	- 0,03		
2	3ph	+ 0,08	+ 0,52	+ 0,02
5	3ph	+ 0,06	+ 0,31	- 0,04
5	1ph,1	- 0,01		
5	1ph,2	+ 0,14		
5	1ph,3	+ 0,08		
10	3ph	0,00	+ 0,22	- 0,07
10	1ph,1		+ 0,34	
10	1ph,2		+ 0,24	
10	1ph,3		+ 0,15	
20	3ph	+ 0,01	+ 0,23	- 0,03
50	3ph	+ 0,01	+ 0,09	+ 0,02
100	3ph	+ 0,01	- 0,03	+ 0,04
100	1ph,1	- 0,03	- 0,06	
100	1ph,2	- 0,03	+ 0,02	
100	1ph,3	- 0,01	- 0,02	
120	3ph	+ 0,02	- 0,04	+ 0,03
120	1ph,1	0,00	- 0,10	
120	1ph,2	+ 0,03	- 0,06	
120	1ph,3	+ 0,01	0,00	

Annex 2

Energy meter, type EPQS 121.01.00

Test with disturbance voltages (Fast transient test)

applied pulse	5 / 50 ns pulse ; Ri = 50 ohm			
	specification of circuit(s)	amplitude (open voltage) in V		res.
			req.	
between input circuits and earth (common mode)	between voltage circuits and earth (no current)	4000	4000	pass
	between current circuits and earth (no current)	4000	4000	pass
	between voltage circuits and earth (with current)	2000	2000	pass
	between current circuits and earth (with current)	2000	2000	pass
between I/O circuits and earth (common mode)	between I/O circuits and earth (with capacitive clamp)	1000	1000	pass

Annex 3

Energy meter, type EPQS 121.01.00

Tests with variations in the supply voltage

applied phenomena in the line voltage	duration of the phenomenon		res.
		req.	
variation in the line voltage			
230 + 15 %	continuous	continuous	pass
57,7 - 15 %	continuous	continuous	pass
57,7 - 20 %	10 - 300 ms	≤ 50 ms	pass
57,7 - 50 %	≤ 20 ms	≤ 20 ms	pass
57,7 - 50 %	≤ 100 ms	≤ 100 ms	pass
57,7 - 50 %	≤ 200 ms	≤ 200 ms	pass
57,7 - 50 %	1 min.	1 min.	pass
interruption in the line voltage	5 - 30 ms	≤ 20 ms	pass
	0,5 s		pass
	1 s	1 s	pass

Annex 4

Energy meter, type EPQS 121.01.00 and EPQS 123.01.00

Dielectric strength tests (Impulse voltage withstand test)

Applied pulse	1,2 / 50 µs pulse ; Ri = 500 Ω			
	Specification of circuits(s)	Amplitude (open voltage) in V	req.	res.
Between input leads (differential mode)	Between leads voltage circuits	6 kV	6 kV	Pass
Between input circuits and earth (common mode)	Between voltage circuits and earth	6 kV	6 kV	pass
	Between current circuits and earth	6 kV	6 kV	pass
	Between I/O circuits and earth	6 kV	6 kV	pass

Dielectric strength tests (Test with 50 Hz during 1 minute)

Applied pulse	50 Hz voltage			
	Specification of circuits(s)	Amplitude (open voltage) in V	req.	res.
Between input circuits and earth (common mode)	Between voltage circuits and earth	4 kV	4 kV	pass
	Between current circuits and earth	4 kV	4 kV	pass
	Between I/O circuits and earth	4 kV	4 kV	pass