

TECHNICAL REPORT

No. : 44187

Client Electrical Safety Council
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Scope of report Screening Test of Energy Saver Plug-in Devices

Sample(s) tested / Condition 5 samples / new


Reference Standards **EN 60335-1:2012**
(with BS1363 & BS5733 as relevant)


Date sample received 17 September 2012


Test period 20 September 2012 to 15 October 2011

Date of issue 22 October 2012

Tests carried out at 20°C ± 5°C

Testing Officer (Part A)  Paul Artopoulos

Testing Officer (Part B)  Richard Newman

Verified by  Peter Cross

Form No: QF102-2
Issue No: 1
Issue Date: 03.08.07



Report No. :	44187
Client :	Electrical Safety Council

THIS REPORT APPLIES ONLY TO THE PARTICULAR SAMPLE UNIT(S) TESTED AND TO THE SPECIFIC TESTS CARRIED OUT AS DETAILED IN THIS REPORT.

Introduction

The Electricity Safety Council established a safety screening testing project for Energy Saver Plug-in Devices and commissioned Nemko Ltd to carry out tests on five devices purchased by the council, under the general safety provisions of the following safety standards:-

EN 60335-1:2012 Household and similar electrical appliances – Safety
Part 1: General requirements

BS1363-1: 13 A plugs, socket-outlets, adaptors and connection units - Part 1:
Specification for rewirable and non-rewireable 13 A fused plugs
(reference for measurement of plug pin dimensions only)

BS 5733: General requirements for electrical accessories

The project also considered the effective performance of the devices against the manufacturer's claims.

Summary

The electrical safety screening tests have been carried out under various headings taken from EN 60335-1 with some additions and consist of inspections and measurement with limited testing. Nemko engineers applied their professional judgement in deciding upon the limited tests carried out and it must be stressed that full testing to the above safety standards is outside the scope of this project. The table below contains the sample details and the summary results.

Sample Code	Marked Specification	Screening Test Result
S1	Power Saver 90-250V 50-60Hz, Useful Load 18000W	Fail
S2	Energy Saver 90-250V~ 50Hz, 0.45W, Max loading 2500W	Fail
S3	Power Saver 90-250V 50-60Hz, Useful Load 18000W	Fail
S4	Energy Saver 90V 250V 50-60Hz, Useful Load 15000W	Fail
S5	Power Saver 90-250V ~ 50-60Hz, Useful Load 50000W	Fail

Details of the Screening Test non-compliances for samples S1 to S5 are shown in the relevant numbered section in Part A of this report on page 4.

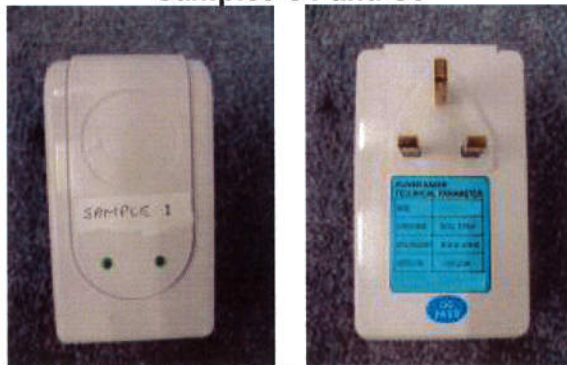
The assessment of the performance of the devices against the manufacturers' claims is detailed in Part B of this report on page 14.

Report No. : 44187
Client : Electrical Safety Council

Project Samples:

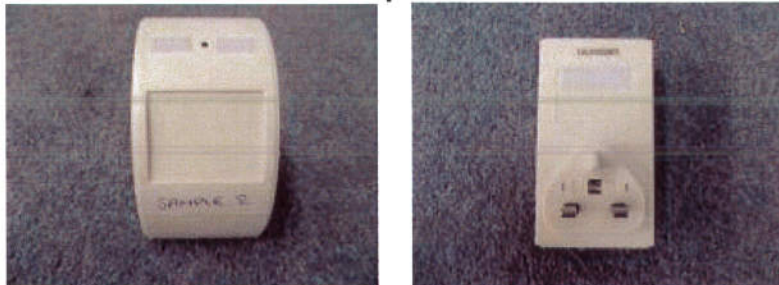
The following five samples were selected for testing under this project:

Samples S1 and S3

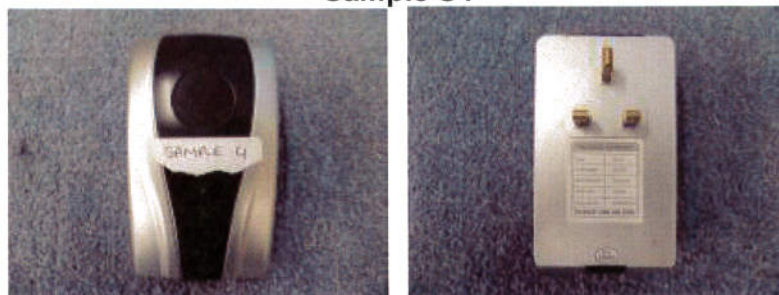


Note: Samples S1 & S3 are identical except Sample 1 was supplied unboxed with no instruction leaflet

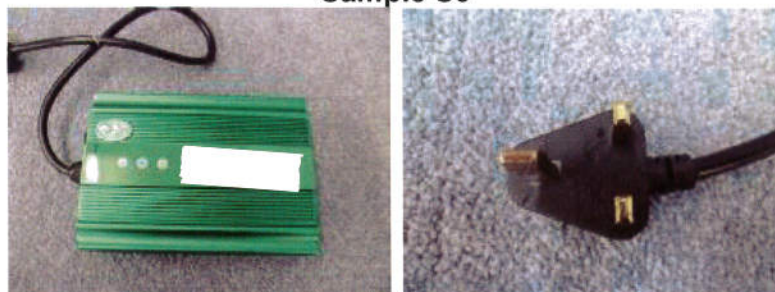
Sample S2



Sample S4



Sample S5



Report No. : 44187
 Client : Electrical Safety Council

PART A. ELECTRICAL SAFETY SCREENING TESTS.

Sample S1 Power Saver



1.1 Test summary

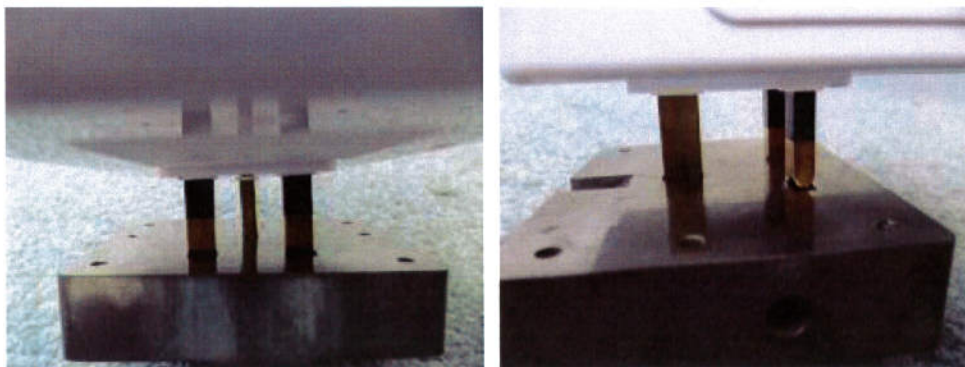
Safety Criteria	Results
Plug dimensions	Fail
Initial operation	Pass
Classification, Marking and instructions & Power input	Fail
Protection against access to live parts	Pass
Heating	Pass
Touch current and electric strength	Pass
Abnormal operation	*Fail
Mechanical strength	Pass
Construction	*Fail
Internal wiring	Fail
Components	Fail
Clearance, creepage distances and solid insulation	*Fail
Resistance to heat and fire	Pass

* = hazardous failure

1.2 Details of non-compliances

Plug dimensions:

The plug does not fit the BS1363 plug gauge and several pin dimensions are outside the tolerances allowed by the standard.



Plug dimensions incorrect

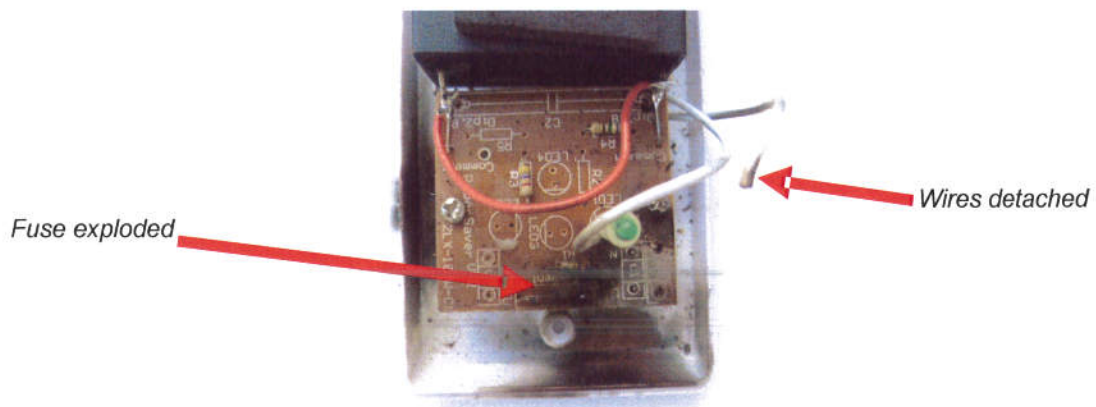
Report No. :	44187
Client :	Electrical Safety Council

Classification, Marking and instructions & Power input:

- The appliance is not marked with any claim that it meets any particular standard.
- CE mark, wheelie bin symbol & Class II symbol are not marked.
- No instruction leaflet supplied.
- Power input not marked.

Abnormal operation:

A short circuit on the 5uF capacitor resulted in the wire-ended fuse exploding, part of the printed track to go open-circuit and the ends of the internal mains wires to become detached from the printed circuit board. We would expect a fuse directly connected to the mains to be high breaking capacity, such that it would remain intact in a short-circuit condition.



Construction:

The ends of the internal wires should be secured independently of their soldered connections such that if one wire end breaks free the creepage distances and clearances will not be reduced below the requirements detailed in EN 60335-1.

Internal wiring:

Internal live and neutral wires are reversed.

Components:

Unidentified glass wire-ended fuse has no approval marks or marked current rating.

Clearance, creepage and solid insulation:

Creepage distance between the accessible part of LED indicator and the live connection measured 3.4mm. (minimum limit: 5mm).

Report No. : 44187
 Client : Electrical Safety Council

Sample S2 Energy Saver



2.1 Test summary

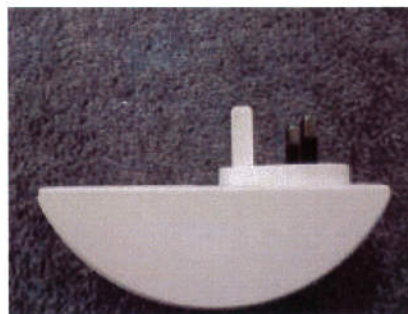
Safety Criteria	Results
Plug dimensions	Fail
Initial operation	Pass
Classification, Marking and instructions & Power input	Fail
Protection against access to live parts	Pass
Heating	Pass
Touch current and electric strength	Pass
Abnormal operation	Pass
Mechanical strength	Pass
Construction	Pass
Internal wiring	Fail
Components	Pass
Clearance, creepage distances and solid insulation	*Fail
Resistance to heat and fire	Pass

* = hazardous failure

2.2 Details of non-compliances

Plug dimensions:

- Both live and neutral pins are shorter than the requirements.



Report No. :	44187
Client :	Electrical Safety Council

Classification, Marking and instructions & Power input:

- The appliance is not marked with any claim that it meets any particular standard.
- The text of EN 60335-1 clause 7.12 relating to children and persons with reduced physical sensory or mental capabilities has not been included in the front of the instruction leaflet in 3mm high characters.

Internal wiring:

- Internal live and neutral wires are reversed.

Clearance, creepage distances and solid insulation:

- Creepage distance between the accessible part of the LED to live parts was measured at 4.35mm (minimum limit: 5mm).

Report No. : 44187
 Client : Electrical Safety Council

Sample S3 Power Saver



3.1 Test summary

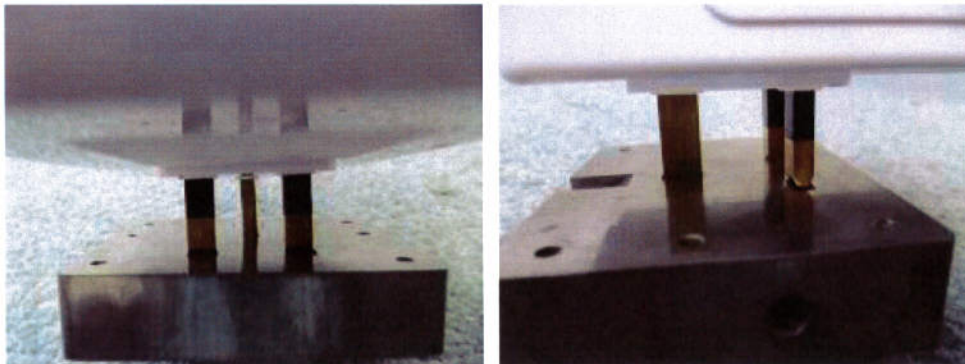
Safety Criteria	Results
Plug dimensions	Fail
Initial operation	Pass
Classification, Marking and instructions & Power input	Fail
Protection against access to live parts	Pass
Heating	Pass
Touch current and electric strength	Pass
Abnormal operation	*Fail
Mechanical strength	Pass
Construction	*Fail
Internal wiring	Fail
Components	Fail
Clearance, creepage distances and solid insulation	*Fail
Resistance to heat and fire	Pass

* = hazardous failure

3.2 Details of non-compliances

Plug dimensions:

The plug does not fit the BS1363 plug gauge and several pin dimensions are outside the tolerances allowed by the standard.



Plug dimensions incorrect

Report No. : 44187
Client : Electrical Safety Council

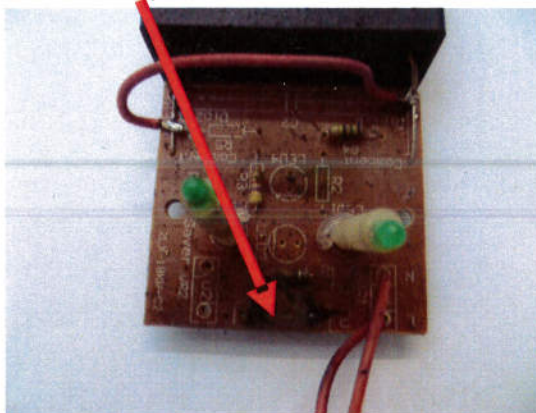
Classification, Marking and instructions & Power input:

- The appliance is not marked with any claim that it meets any particular standard.
- CE mark, wheelie bin symbol & class II symbol are not marked.
- The instructions state "Keep away from children" but the specific text of EN 60335-1 clause 7.12 relating to children and persons with reduced physical sensory or mental capabilities has not been included in the front of the instruction leaflet in 3mm high characters.
- Power input not marked.

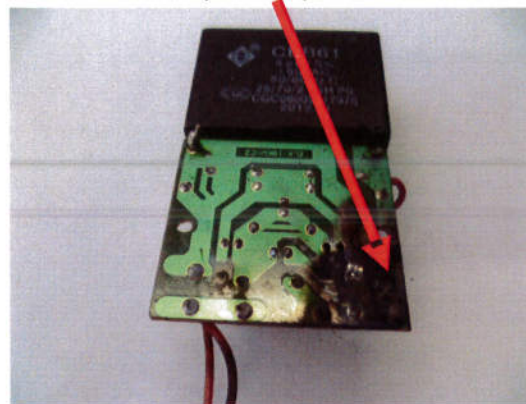
Abnormal operation:

A short circuit on the 5uF capacitor resulted in the wire ended fuse exploding and part of the printed track to go open-circuit with some scorching of the printed circuit board. We would expect a fuse directly connected to the mains to be high breaking capacity, such that it would remain intact in a short-circuit condition.

Fuse exploded



Printed pattern open-circuit



Construction:

The ends of the internal wires should be secured independently of their soldered connections such that if one wire end breaks free the creepage distances and clearances will not be reduced below the requirements detailed in EN 60335-1.

Internal wiring:

Internal live and neutral wires are reversed.

Components:

Unidentified glass wire-ended fuse has no approval marks or marked current rating.

Clearance, creepage and solid insulation:

Creepage distance between accessible part of LED indicator and the live connection measured 3.4mm. (minimum limit: 5mm).

Report No. : 44187
 Client : Electrical Safety Council

Sample S4 Energy Saver



4.1 Test summary

Safety Criteria	Results
Plug dimensions	Fail
Initial operation	Pass
Classification, Marking and instructions & Power input	Fail
Protection against access to live parts	Pass
Heating	Pass
Touch current and electric strength	Pass
Abnormal operation	*Fail
Mechanical strength	Pass
Construction	Pass
Internal wiring	Fail
Components	Fail
Clearance, creepage distances and solid insulation	*Fail
Resistance to heat and fire	*Fail

* = hazardous failure

4.2 Details of non-compliances

Plug dimensions:

- The plug does not fit the BS1363 plug gauge and several pin dimensions are outside the tolerances allowed by the standard.

Classification, Marking and instructions & Power input:

- The appliance is not marked with any claim that it meets any particular standard.
- CE mark, wheelie bin symbol & class II symbol are not marked.
- The text of EN 60335-1 clause 7.12 relating to children and persons with reduced physical sensory or mental capabilities has not been included in the front of the instruction leaflet in 3mm high characters.
- Power input not marked.

Report No. :	44187
Client :	Electrical Safety Council

Abnormal operation:

The appliance has no internal mains fuse and a short circuit on the 5uF capacitor caused the breaker in the installation to trip. Plug-in appliances must not rely on external devices for short circuit protection.

Internal wiring:

- The live and neutral wires are reversed.

Components:

-The large capacitor wired across the mains has no markings and no approval marks and capacitor C1, in the mains circuit also has no approval marks.

Clearance, creepage distances and solid insulation:

Creepage distance between accessible part of LED indicator and the live connection measured 4.6mm. (minimum limit: 5mm).

Resistance to heat and fire:

- The enclosure fails the Glow Wire test at 850°C. Flame does not extinguish within 30 seconds

Report No. : 44187
 Client : Electrical Safety Council

Sample S1 Power Saver



5.1 Test summary

Safety Criteria	Results
Plug dimensions	*Fail
Initial operation	Pass
Classification, Marking and instructions & Power input	Fail
Protection against access to live parts	*Fail
Heating	Pass
Touch current and electric strength	Pass
Abnormal operation	Pass
Mechanical strength	Pass
Construction	*Fail
Internal wiring	*Fail
Components	Fail
Clearance, creepage distances and solid insulation	Pass
Resistance to heat and fire	Pass

* = hazardous failure

5.2 Details of non-compliances

Plug dimensions:

- Appliance is fitted with an illegal non-approved moulded plug with no fuse.



Illegal Plug

Report No. :	44187
Client :	Electrical Safety Council

Classification, Marking and instructions & Power input:

- The appliance is not marked with any claim that it meets any particular standard but the label has UL & CQC marking. In view of the non-compliances, it is likely that these marks are fake.
- Wheelie bin symbol is not marked.
- The instructions state "Keep away from children" but the specific text of EN 60335-1 clause 7.12 relating to children and persons with reduced physical sensory or mental capabilities has not been included in the front of the instruction leaflet in 3mm high characters.
- Power input not marked.
- The external fuse holder is not marked with the fuse rating F5AL 250V

Protection against access to live parts:

- A live screw thread is accessible by hand when the external fuse cap is unscrewed.



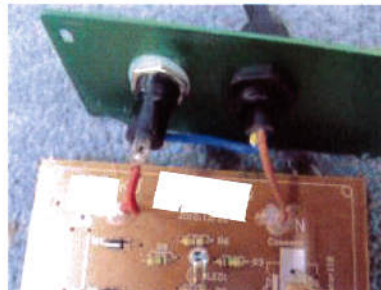
Shows live screw thread accessible by hand.

Construction:

The wires to the fuse-holder should be secured independently of their soldered connections such that if one wire end breaks free the creepage distances and clearances will not be reduced below the requirements detailed in EN 60335-1.

Internal wiring:

- The live and neutral wires are reversed and the mains cord earth conductor is not connected to the metal case.



Reversed L & N wiring and cut earth conductor

Components:

- External fuse-holder and fuse have no approval marks.

Report No. :	44187
Client :	Electrical Safety Council

PART B. ASSESSMENT OF PERFORMANCE OF DEVICES AGAINST THE MANUFACTURERS' CLAIMS.

Manufacturers' Claims

The Energy Saver Devices all claimed to provide an energy saving or a reduction in electricity costs. In the case of three samples, the expected percentage reduction is also claimed:-

Sample 2: "Typical energy saving of 10-13%".

Sample 3: "Proven to save up to 35% in electricity costs".

Sample 5: "Proven to save up to 35% in electricity costs".

Test results

Each Energy Saver Device was plugged in together with a typical domestic LCD television and the power consumption in watts @ 240V 50Hz was measured with and without the device in circuit. The appendix on page 15 gives additional background information.

	Television only (watts)	Device + Television (watts)	Saving
Sample S1	75.14	76.23	None
Sample S2	75.14	75.93	None
Sample S3	75.14	75.92	None
Sample S4	75.14	75.66	None
Sample S5	75.14	75.83	None

(Note: The TV load is fixed, so measurements of watt-hours are not necessary).

Conclusion

As a result of the above tests, the manufacturers claims of energy saving or cost reduction have been shown to be unjustified.

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

Report No. :	44187
Client :	Electrical Safety Council

Appendix

Note on Power Factor and Power Factor Correction

General

1 In an AC circuit, the true or active power (watts) is less than the apparent power (VA) and is dependent upon the power factor.

2 Thus, in a single phase AC circuit, the power is calculated from the equation:

$$\text{true power } P = IV \cos\Phi$$

$$\text{apparent power } S = IV$$

where:

I = current in rms amps

V = voltage in rms volts

$\cos\Phi$ = power factor PF (this value can vary between 1 and 0)

Φ = phase angle between voltage and current.

3 A lagging phase angle, ie current lagging voltage, is an inductive circuit, whilst a leading phase angle, ie current leading voltage, is a capacitive circuit. A purely resistive circuit has a power factor of 1, ie the current is in phase with the voltage. Thus the lower the power factor, the lower the true power. A purely capacitive current will lead the voltage by 90° (ie $\cos\Phi = 0$), but in practice all capacitors have losses and therefore the phase angle will be a fraction less than 90° . In the case of the capacitive currents of the 5 samples, their capacitive current phase angles range from 89.43° to 89.71° .

4 Normally, most electrical installations have a lagging phase angle, and thus are inductive. Power factor correction is facilitated by installing a capacitive load that balances to some degree the inductive reactive power, and this will increase the power factor.

5 Note that power factor correction does not reduce or alter the true or active power and hence does not reduce watts, or watt-hours.

Report No. :	44187
Client :	Electrical Safety Council

Note on the Electricity Supply Authority

- 6 A supply authority is greatly motivated to maintain a high power factor and penalises industrial firms that have a low power factor, through their tariff system. Because of this, many industrial firms install power factor correction, usually banks of large capacitors. The capacitive current reduces the high inductive currents found in industrial plants, caused by, for example, induction motor drives, thus reducing their electricity costs.

Note on Domestic loads

- 7 Domestic tariffs do not carry any penalty for a possible low power factor.

Note on the Five Test Samples

- 8 The five samples are referred to as S1, S2, S3, S4 and S5.
- 9 S1 and S3 appear to be identical. S1, S2, S3 and S4 contain a single capacitor of value $5\mu\text{F}$. S5 contains 3 capacitors in parallel, each of value $5\mu\text{F}$.
- 10 In all the samples the capacitors are effectively connected directly across the mains terminals.
- 11 When tested, the 5 samples caused small capacitive currents as illustrated in Table 1 below.

Report No. : 44187
Client : Electrical Safety Council

Table 1. Sample Currents

Samples only connected to 240V, AC, 50 Hz supply

Sample Number	I Current (amps)	P True Power (watts)	S Apparent Power (VA)	PF Power Factor	Φ Phase Angle (degrees)
S1	0.374	0.923	90.05	0.010	89.43
S2	0.522	0.610	125.52	0.005	89.71
S3	0.380	0.942	90.69	0.010	89.43
S4	0.471	0.529	113.96	0.005	89.71
S5	1.152	1.315	275.60	0.005	89.71

Note on the Test Samples and the Claim for Cost Savings

12 As explained in the opening paragraphs 1 to 5, power factor correction reduces the reactive power but does not reduce the active or true power, and thus for domestic premises, where there is no tariff charge or penalty concerning reactive power, the claim that the samples reduce electricity costs is not correct. In fact, due to the losses in the capacitors there will be a tiny increase in active power. There is also an in-phase loss due to the other components in the samples. Therefore, the claim for cost savings is not substantiated.
