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FOREWORD

Recommendations for corrections, additions or deletions should be addressed to the:

Technology Services Manager
City Power Johannesburg (SOC) Ltd
P O Box 38766
Booysens
2016

Introduction

A photoelectric control unit (PECU), also known as a photocell or daylight switch, is a device that responds to variations in the amount of available light to switch a streetlight or circuit on and off. The reliability of these devices has a direct impact on levels of customer satisfaction as well as the quality of supply.

1. Scope

This specification covers City Power's requirements for photoelectric control units (PECUs)(also known as daylight switches) for the lighting installations designed to switch a reactive load not exceeding 1 800 VA at 230 V and 50 Hz in accordance with SANS1777.

2. Normative references

The following documents contain provisions that, through reference in the text, constitute requirements of this specification. At the time of publication, the editions indicated were valid. All standards and specifications are subject to revision, and parties to agreements based on this specification are encouraged to investigate the possibility of applying the most recent editions of the documents listed below.

SANS 1777, *Photoelectric Control Units for lighting (PECUs)*

SANS 60529/IEC 60529 (SABS IEC 60529), *Degrees of protection provided by enclosures (IP Code)*.

SANS 60598-1/IEC 60598-1, Luminares-Part1: General requirements and tests.

3. Definitions and abbreviations

The following definitions and abbreviations shall apply to this specification:

3.1 **Detector**: Part of a two-part PECU that contains the photoelectric sensor

3.2 **Lead wires:**3 separate wires lead from a one-part PECU and are intended for direct connection to the power supply and the load.

3.3 **NEMA base:** (see **Socket**) A receptacle, generally of a design first published by the National Electrical Manufacturers Association (NEMA) of the USA, and as illustrated in SANS 1777.

3.4 **One-part PECU**: A photoelectric control unit in which the photoelectric sensor and the load-switching device are housed in the same enclosure.

3.5 **Photoelectric control unit (PECU):** Device that comprises a photoelectric sensor that responds to variations in illuminance combined with a means of switching an electric load

3.6 **Socket (NEMA base):** A receptacle into which a one-part PECU can be inserted.

3.7 **Switching differential:** The ratio of the measured switch-ON level to the measured switch-OFF level.

3.8 **Switch-OFF level:** That illuminance at the photoelectric control unit that will cause it to change from the "ON" to the "OFF" mode under standard test conditions.

3.9 **Switch-ON level:** That illuminance at the photoelectric control unit that will cause it to change from the "OFF" to the "ON" mode under standard test conditions.

3.10 **Two-part PECU:** PECU in which the photoelectric and the load switching are housed in separate enclosures.

3.11 **Tracking**: Progressive formation of conducting paths on the surface of a solid insulating material, due to the combined effects of electric stress and electrolytic contamination on this surface.

3.12 **Load switching device:** mechanical device capable of making, carrying and breaking of currents under normal circuit conditions.

3.13 **Switching unit:** part of a two PECU that contains the load switching device.

4. Requirements

4.1 General

4.1.1 A PECU shall be designed as a NEMA plug-in unit or as a fixed unit for direct connection, as required. It shall consist of one or two parts and shall be intended for indoor or outdoor installation, as required, and for operation at ambient temperatures from -15 °C to +65 °C.

4.1.2 The photoelectric sensor of a PECU shall be omnidirectional and designed to be mounted facing upwards in such a way that no particular orientation is required.

4.1.3 The cover and gaskets of the photoelectric sensor shall be ultraviolet stabilized, and they shall be designed to resist normal climatic conditions such as moisture, heat, cold and compression.

4.2 Mechanical performance

4.2.1 The cover of the photoelectric sensor of a PECU shall be of a conical or spherical shape to minimise the accumulation of dust or dirt, and to discourage the perching of birds.

4.2.2 A PECU shall be designed to plug into a NEMA base, or it shall be fitted with lead wires of conductor size 1,5 mm^2 and of length at least 300 mm, and with a 20 mm screw entry suitable for being fixed into a 20 mm diameter mounting hole, as required.

4.2.3 PECUs shall be of adequate mechanical strength and so constructed as to withstand the stresses imposed during installation and normal use, including handling and vibration as per clause 4.2.4 of SANS 1777.

4.2.4 The degrees of protection provided for parts of a PECU as determined in accordance with SANS 60529, shall be at least IP 65 in accordance with SANS 60529. In addition, neoprene sealing gasket shall be provided as part of the PECU to form a weatherproof seal between the PECU and its NEMA base.

4.2.5 All materials used in the manufacture of the PECU shall be ultra-violet stabilized, and shall not deteriorate as a result of solar radiation, heat, moisture, cold or compression. In addition, damage due to solar radiation should not cause the photometric performance of the PECU to deteriorate beyond the specified limits within a period of at least 10 years.

4.3 Electrical performance

4.3.1 A PECU shall be capable of operating with an r.m.s. 50 Hz a.c. supply voltage of 230 V ± 10 %. The construction of a PECU shall be such that double insulation is provided.

4.3.2 When a d.c. voltage not exceeding 500 V is applied for 1 min between the parts of a PECU as specified in column 1 of table 1, the insulation resistance of the PECU, including the plug and the NEMA base, shall be as specified in column 2 of table 1.

4.3.3 When the dielectric strength of a PECU, including the plug and the NEMA base, is tested in accordance with clause 5.9 of SANS 1777, no breakdown or flashover shall occur.

4.3.4 A PECU shall be fitted with a suitable surge suppressor that shall enable the PECU to withstand an induced lightning surge as specified in clause 5.7 of SANS 1777.

4.3.5 Contacts of the plug and of the NEMA base shall be so designed as to ensure sufficient contact pressure without causing any overheating or deterioration of the material or decline in functioning.

4.3.6 Terminals shall allow for the connection of conductors of nominal cross-sectional area 1, 5 mm^2.

4.3.7 The insulation system shall be of at least class E (120 °C), in accordance with IEC 60085.

4.3.8 The PECU shall be designed to fail at the "on" position of the switch.

4.3.9 When components are assembled in the most unfavourable positions, creepage distances and clearances shall still be in accordance with the requirements of section 11 of SANS 60598-1.

Table 1 – Insulation resistance and test voltage of PECUs

1	2	3	4
Points of application of test voltages	**Minimum insulation resistance** MΩ	**Test voltage** V	**Notes**
a) Between live parts and accessible metal	4	2*U* + 3 500	All live parts shall be connected together.
b) Between live metal parts at different polarities	2	2*U* + 1 000	–
c) Between live parts that can achieve different polarities when switched. Test shall be made immediately after the contacts have been opened	2	2*U* + 1 000	Contacts shall be opened, closed and checked by using a filament lamp.
d) Between live parts and non-earthed accessible metal or metal foil over non-metal surfaces	4	2*U* + 3 500	All live parts shall be connected together.
NOTE *U* is the rated voltage of the PECU, in volts.			

4.3.10 The PECU shall be capable of performing at least 8 000 switching operations. A single operation is defined as the transfer of the moving contacts from one operating position to another, or, in the case of electronic switching, a change from one state to another. Test reports on the switching cycles, provided by an independent authority, will suffice.

4.3.11 The construction of the PECU shall provide double-insulation.

4.3.12 The PECU shall be fitted with an integral surge suppression device (e.g. MOV) in order that it may withstand an induced lightning strike or other mains-borne disturbance.

4.4 Photometric performance

4.4.1 When a PECU is tested;

a) the switch-on level shall be 60 lux ± 12 lux, unless otherwise required;
b) the switch-off level shall be not greater than 1,5 times the switch-on level, unless otherwise required; and
c) Switching operations shall be delayed by at least 15 s to prevent spurious operation caused by events such as lightning flashes and headlights of passing cars.

4.4.2 When a PECU is tested in accordance with clause 5.5 of SANS 1777both before and after 1 000 switching operations, the switch-on and switch-off levels at 90 % and 110 % of the rated voltage shall be within 5 % of the switch-on and switch-off levels at the rated voltage.

4.4.3 The NEMA base shall comply in all respects with dimensions and designs as per Figure 1, 2, and 3 of SANS 1777.

4.5 Type Testing

4.5.1 The PECUs and NEMA bases shall meet or exceed the requirements of the type tests specified in SANS 1777and this specification.

4.5.2 Copies of test reports, detailing the test procedures and test results on the items offered, shall be submitted in order for the items to be considered. The test reports shall be from a recognised test authority acceptable to City Power.

4.5.3 Sample tests, which shall include all the type tests specified in SANS 1777 and this specification, shall be carried out on 3 (three) PECUs and sockets randomly selected by City Power. These tests shall be made before the first delivery is made and again approximately halfway through the duration of the contract.

4.5.4 The PECU shall withstand, without excessive wear or harmful effect, the mechanical, electrical and thermal stresses occurring in normal use. During the test all enclosures shall be in place and the specimens shall operate correctly. PECUs shall be subjected to the following test: The PECU is loaded with the specified load and at 110% of the rated voltage. The PECU is then subjected to 8 000 switching operations (4 000 ON, 4 000 OFF) with an OFF-time less than 30 seconds and an ON-time of between 15 and 200 seconds.

4.5.5 The endurance test circuit shall be similar to that described in SANS 1777. However, the PECU under test shall be placed in series with a load of 2 × 400 W HPS luminaries with all associated equipment (ballast, capacitor and lamp). The test circuit should provide a reactive load of at least 1 800 VA. The ballasts shall be suitable for use with the lamps. The capacitors shall have individual capacitances of 40 µF or 45 µF.

4.5.6 In addition to the requirements of SANS 1777, it is required that the photometric performance of the PECU be within the tolerances specified i.e. ±10%. In addition, the calibrated switch-ON and switch-OFF levels shall differ from the specified levels by no more than 10% both before and after environmental testing, at a colour temperature of 3 500 K.

4.6 Guarantee

Suppliers shall guarantee each PECU for a minimum period of 10 years from date of manufacture, during which time any faulty units shall be replaced free of charge. Suppliers shall be responsible for collecting failed PECUs from, and delivering free replacements to City Power, at any one of its depots. PECUs bearing a date of manufacture exceeding four (4) months prior to the date of delivery shall not be accepted.

4.7 Packing and marking

4.7.1 Each PECU shall be individually packed in cartons to prevent damage or deterioration during transport, handling and storage. In addition, each base shall be individually packed (in cartons or packets) and fully assembled together with its associated screws, gaskets and sealing cap.

4.7.2 Each PECU shall be clearly and indelibly marked in accordance with SANS 1777. In addition to the requirements of SANS 1777, each PECU and socket shall be marked with the month and

year of manufacture. It is not necessary for the PECU or base to have the facility to mark the date of installation.

4.7.3 In addition to the requirements of 4.7.2 each PECU shall be indelibly marked with the firefly logo of City Power Johannesburg as well as the letters “CPJ” so that there can be no doubt about ownership of the PECU. The marking shall be easily visible whilst the PECU is in service. At the sole discretion of the General Manager: Infrastructure Planning, the marking shall be identical to that described above, except that the logo and letters may be replaced with the words “City Power”.

4.8 Documentation

Full technical information and descriptive literature relating to the items offered shall be submitted in order that the items can be fully evaluated. This shall include;

(1) materials used in the manufacture of the items;

(2) the method of manufacture;

(3) Test reports in English:

(4) details of quality assurance procedures;

(5) drawings; and

(6) details of tests carried out, etc.

5. QUALITY MANAGEMENT

A quality management plan shall be set up in order to assure the proper quality management of the PECUs and NEMA bases during design, development, production, installation and servicing phases. Guidance on the requirements for a quality management plan may be found in the SANS ISO 9000 and SANS ISO 9001. The details shall be subject to agreement between City Power and supplier.

6. ENVIRONMENTAL MANAGEMENT

An environmental management plan shall be set up in order to assure the proper environmental management of the PECUs and NEMA bases throughout their entire life cycle (i.e. during design, development, production, installation, operation and maintenance, decommissioning and disposal phases). Guidance on the requirements for an environmental management system may be found in SANS ISO 14001 standards. The details shall be subject to agreement between City Power and supplier. This is to ensure that the asset created conforms to environmental standards and City Power SHEQ Policy.

Annex A - Revision information

DATE	REV. NO.	NOTES
Sept 2002	0	First Issue
Feb 2008	1	Include NEMA Category B PECU designed to fail in the OFF position Updated operating voltage to 240V Include NEMA Category B PECU designed to fail in the OFF position
October 2012	2	Updated operating voltage to 240V Include Category A & B Micro Type PECU; 20mm Updating committee members Removal of Fail-OFF PECUs Inclusion of clause 5 : Quality Management Inclusion of clause 6 : Environmental Management General editing
October 2012	3	General Editing
June 2017	4	Removal 4.5.1 **In addition the PECUs shall be tested and approved by eThekwini Municipality testing facility before it can be accepted by City Power. An approved letter with both logos of City Power and eThekwini municipalities shall be produced on Tender.**…. (reason: not SANAS approved) Removal 4.5.2 It is required by City Power that the supplier send samples to eThekwini Municipality Testing Facility for type test and approved letter. (reason: not SANAS approved)

Annex B

Technical schedules A and B for

Photoelectric control units (NEMA plug-in type)

Schedule A: Purchaser's specific requirements
Schedule B: Guarantees and technical particulars of equipment offered

Item	Sub-clause of CP_TSSPEC_012	Description		Schedule A	Schedule B
1		Name of manufacture		XXXXX	
2		Date of manufacture		XXXXX	
3		Place of manufacture		XXXXX	
4		Manufacturer's identification reference		XXXXX	
5	1	Specification to which PECU complies		SANS 1777	
6	4.1.1	Rated operating ambient temperatures	ºC	-15 to +65	
7	4.1.3	Ultraviolet stabilised	Yes/No	Yes	
8	4.2.4	PECU's Degree of protection		IP65 (Minimum)	
9	4.3.1	Rated operating voltage	V	230±10%	
10	4.3.5	Rated switching load (reactive)	VA	1800	
11	4.3.8	Is PECU designed for Fail On?	Yes/No	Yes	
12	4.3.9	Switch-On level at rated voltage	Lux	60±10%	
13		Power consumption in "ON" state	W	<1,0	
14	4.1.3	Switch-ON level at rated voltage	Lux	60±10%	
15	4.3.10	Number of switching operations that PECU has been tested to:		8000 (Minimum)	
16	4.3.11	Does PECU have Double Insulation?	Yes/No	Yes	
17	4.4	Does PECU comply with clause 4.4?	Yes/No	Yes	
18	4.5	Does PECU comply with clause 4.5?	Yes/No	Yes	
19	4.6	Guarantee	Years	10	
20	4.7	Does PECU comply with per clause 4.7?	Yes/No	Yes	
21	4.8	Does the supplier submitted all documents as per clause 4.8	Yes/No	Yes	
22	5	Quality Management? (ISO 9001 or Quality Programme)	Yes/No	Yes	
23	6	Environmental Management? (ISO 14001)	Yes/No	Yes	

NOTE: TICKS [✓✗], ASTERISK [*], WORD [NOTED], OR TBA [TO BE ADVISED] SHALL NOT BE ACCEPTED.

Tender Number: _____

Tenderer's Authorised Signatory: _____ _____
Name in block letters Signature

Full name of company: _____

Technical schedules A and B

for

Photoelectric control units (NEMA plug-in type)

Deviation schedule

Any deviations offered to this specification shall be listed below with reasons for deviation. In addition, evidence shall be provided that the proposed deviation will at least be more cost-effective than that specified by City Power.

Item	Clause	Proposed deviation

Tender Number: _____

Tenderer's Authorised Signatory: _____ _____
Name in block letters Signature

Full name of company: _____

Technical schedules A and B

for

Photoelectric control units (Miniature or Micro type)

Schedule A: Purchaser's specific requirements
Schedule B: Guarantees and technical particulars of equipment offered

Item	Sub-clause of CP_TSSPEC_012	Description		Schedule A	Schedule B
1		Name of manufacture		XXXXX	
2		Date of manufacture		XXXXX	
3		Place of manufacture		XXXXX	
4		Manufacturer's identification reference		XXXXX	
5	1	Specification to which PECU complies		SANS 1777	
6	4.1.1	Rated operating ambient temperatures	ºC	-15 to +65	
7	4.1.3	Ultraviolet stabilised	Yes/No	Yes	
8	4.2.4	PECU's Degree of protection		IP65 (Minimum)	
9	4.3.1	Rated operating voltage	V	230±10%	
10	4.3.5	Rated switching load (reactive)	VA	1800	
11	4.3.8	Is PECU designed for Fail On?	Yes/No	Yes	
12	4.3.9	Switch-On level at rated voltage	Lux	60±10%	
13		Power consumption in "ON" state	W	<1,0	
14	4.1.3	Switch-ON level at rated voltage	Lux	60±10%	
15	4.3.10	Number of switching operations that PECU has been tested to:		8000 (Minimum)	
16	4.3.11	Does PECU have Double Insulation?	Yes/No	Yes	
17	4.4	Does PECU comply with clause 4.4?	Yes/No	Yes	
18	4.5	Does PECU comply with clause 4.5?	Yes/No	Yes	
19	4.6	Guarantee	Months	42	
20	4.7	Does PECU comply with per clause 4.7?	Yes/No	Yes	
21	4.8	Does the supplier submitted all documents as per clause 4.8	Yes/No	Yes	
22	5	Quality Management? (ISO 9001 or Quality Programme)	Yes/No	Yes	
23	6	Environmental Management? (ISO 14001)	Yes/No	Yes	

NOTE: TICKS [✓✗], ASTERISK [*], WORD [NOTED], OR TBA [TO BE ADVISED] SHALL NOT BE ACCEPTED.

Tender Number: _____

Tenderer's Authorised Signatory: _____ _____
Name in block letters Signature

Full name of company: _____

Technical schedules A and B

for

Photoelectric control units (Miniature or Micro type)

Deviation schedule

Any deviations offered to this specification shall be listed below with reasons for deviation. In addition, evidence shall be provided that the proposed deviation will at least be more cost-effective than that specified by City Power.

Item	Clause	Proposed deviation

Tender Number: _____

Tenderer's Authorised Signatory: _____ _____
Name in block letters Signature

Full name of company: _____

Technical schedules A and B

for

NEMA bases

Schedule A: Purchaser's specific requirements
Schedule B: Guarantees and technical particulars of equipment offered

Item	Sub-clause of CP_TSSPEC_001	Description		Schedule A	Schedule B
1		Name of manufacture		XXXXX	
2		Date of manufacture		XXXXX	
3		Place of manufacture		XXXXX	
4		Manufacturer's identification reference		XXXXX	
5	1	Specification to which socket complies		SANS 1777	
6	4.1.1	Rated operating ambient temperatures	ºC	-15 to +65	
7	4.1.3	Ultraviolet stabilised	Yes/No	Yes	
8	4.3.1	Rated operating voltage	V	230±10%	
9	4.4.3	Does NEMA base comply with 4.4.3?	Yes/No	Yes	

NOTE: TICKS [✓✗], ASTERISK [*], WORD [NOTED], OR TBA [TO BE ADVISED] SHALL NOT BE ACCEPTED.

Tender Number: _____

Tenderer's Authorised Signatory: _____ _____
Name in block letters Signature

Full name of company: _____

Technical schedules A and B

for

NEMA bases

Deviation schedule

Any deviations offered to this specification shall be listed below with reasons for deviation. In addition, evidence shall be provided that the proposed deviation will at least be more cost-effective than that specified by City Power.

Item	Clause	Proposed deviation

Tender Number: _____

Tenderer's Authorised Signatory: _____ _____
Name in block letters Signature

Full name of company: _____

Annex C–PECU tender requirements

Specification number: CP_TSSPEC_012

Material Group: PECU

Item	SAP number	SAP Short Description	SAP Long Description
1	6279	PECU NEMA TYPE 1800VA FAIL ON	PECU 1800VA FAIL ON 230 V. ITEM SPECIFICATIONCP_TSSPEC_012.
2	6280	PECU NEMA BASE	PECU 1800VA 230 V. ITEM SPECIFICATION CP_TSSPEC_012
3	6295	PECU MICRO TYPE 1800VA FAIL ON	PECU MICRO 1800VA FAIL ON 230 V. ITEM SPECIFICATIONCP_TSSPEC_012