

Installation of an upgrade kit on Standard Reference Photometers

Additional note to the protocol of the Key Comparison BIPM.QM-K1,
Ozone at ambient level

1.1. Introduction

Following the study on systematic biases and measurement uncertainties in the NIST Standard Reference Photometer conducted by the BIPM and the NIST¹, the NIST has developed a kit to be installed on SRPs in order to minimise the two major biases revealed during the study. The kit can be purchased from the NIST and installed in existing SRPs either by NIST staff at NIST or in the SRP owner's laboratory, or by BIPM staff at the BIPM during a visit to participate in the on-going key comparison BIPM.QM-K1. This additional note to the protocol of BIPM.QM-K1 describes the special protocol which will be followed for participants wishing to have their SRP upgraded at the BIPM.

The BIPM staff has been fully trained by NIST during the installation of this kit on one of the BIPM SRPs (SRP32).

1.2. Purchase of upgrade kits

The purchase of SRP upgrade kits is not part of the comparison protocol. However all SRP kits must be purchased from the NIST. Laboratories wishing to have their kits installed at the BIPM should contact the NIST at least three months prior to their intended visit date to the BIPM, and receive confirmation from the NIST that the kit will be constructed and delivered to their laboratory sufficiently in advance to send or bring the kit at the BIPM with the SRP, otherwise the laboratory will need to revise the date for their comparison.

The costs for installation charged by the BIPM will be 760€ Laboratories should send requests for quotations to Joële Viallon (jviallon@bipm.org), and the BIPM will require a purchase order number from laboratories prior to the installation date.

Requests for quotes for the construction and delivery of SRP kits by the NIST should be sent to James Norris (james.norris@nist.gov) and Frank Guenther (franklin.guenther@nist.gov).

1.3. Description of the upgrade kit

The kit upgrades two elements of the SRP optical bench²:

- A new set of absorption cells have been designed to minimise the bias in the light path length. The new cells are quartz tubes (90 cm long, 13 mm diameter) closed at both ends by optically sealed quartz windows. These windows are parallel but not perpendicular to the light path. They are tilted by 3° to avoid multiple reflections along the light path.

¹ Viallon, J., et al., Metrologia, 2006. 43: 441-450.

² See the presentation of Jim Norris during the GAWG meeting in April 2006: document GAWG06-23 on <http://www.bipm.org/wg/CCQM/GAWG/Restricted/welcome.jsp>

- A new source block has been designed to minimise the gas temperature evaluation bias by better thermally insulating the UV source lamp (heated at a temperature of about 60°C) from the rest of the optical bench, thus avoiding the temperature gradient observed in the SRP when the original source block is used.

1.4. Protocol of the upgrade

The full exercise is organised in three steps: a pre- upgrade comparison between the SRP to be upgraded and the BIPM SRP which serves as reference for BIPM.QM-K1 (BIPM SRP27), the upgrade itself, and finally a post-upgrade comparison between the upgraded SRP and the reference BIPM SRP27. The pre and post upgrade comparisons will be conducted following the protocol A of BIPM.QM-K1. The entire process will be performed at the BIPM.

As the upgrade does not require the SRP to be turned off, the post-comparison shall not include any stabilisation time. Based on the upgrade of BIPM SRP32 performed in January 2007 at the BIPM, a total of 5 days will be required to complete the comparisons and upgrade. This number may increase if problems are encountered.

1.5. Reporting of results

Following the pre **and** the post upgrade comparisons, the measurement results together with the uncertainties and any additional information required will be reported in the excel forms BIPM.QM-K1-R1-LAB-YY-i.xls (LAB stands for the laboratory acronym, YY stands for the year, i equals 1 or 2 for the pre or the post comparison).

As required in the BIPM.QM-K1 protocol, the standard uncertainties associated with the ozone mole fractions values measured by the upgraded SRP will be evaluated by the participating laboratory. It should be emphasized that the uncertainty budgets applied to the SRP before and after the upgrade may be different.

A report will be written following the rules described in protocol A of BIPM.QM-K1. The report will include the results of the pre-comparison, a brief description of the upgrade, and the results of the post-upgrade comparison.